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LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 9/81)

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CONTENTS

PHYSIOLOGY

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PHYSIOLOGY

FUNCTIONAL STRUCTURES OF THE SECOND SIGNALING SYSTEM--PSYCHOPHYSIOLOGICAL MECHANISMS OF INTERNAL SPEECH

Moscow FUNKTSIONAL'NYYE STRUKTURY VTOROY SIGNAL'NOY SISTEMY. PSIKHOFIZIOLOGICHESKIYE MEKHANIZMY VNUTRENNEY RECHI in Russian 1979 (signed to press 21 Feb 79) pp 2-5, 247-248

[Annotation, introduction and table of contents from book "Functional Structures of the Second Signaling System--Psychophysiological Mechanisms of Internal Speech", by Tat'yana Nikolayevna Ushakova, Institute of Higher Nervous Activity and Neurophysiology and Institute of Psychology, USSR Academy of Sciences, Izdatel'stvo "Nauka", 3200 copies, 248 pages]

[Text] An effort was made in this work to conduct a psychophysiological study of complex intraverbal and thinking processes, the manifestations of which are the concern of psychology and linguistics. The teaching of I. P. Pavlov was the theoretical basis. It is very urgent to work on the problem of mechanisms of higher mental processes and, accordingly, the problem of controlling them in the light of the tasks in medical and pedagogic practice, cybernetics and science theory.

Introduction

This book deals with a subject that has been little-covered in the literature--the second signaling system. The concept of second signaling system was formulated by I. P. Pavlov in the last years of his life [109]. Its general orientation is that the routes of physiological analysis of the most complex and specific forms of man's mental activity, primarily verbal and intellectual processes are to be delineated from the standpoint of the teaching on higher nervous activity. This object of study is very complex, since it differs substantially, in many respects, from the science of higher nervous activity studies in animals.

The followers of I. P. Pavlov have accomplished quite a bit to develop the conception of the second signaling system; however, even now, much remains open for research, as well as debate. Not infrequently, inconsistencies arise even with definition of the subject when studying the second signaling system. It is equally difficult to determine the methods used. We find that the basic questions of theory of second signaling system require discussion. The theoretical problems that are the most closely related to the subsequent contents of this book are discussed in Chapter 1 of this work.

The main direction of our study was to add to the range of studied phenomena in the second signaling system not only some simple forms of verbal activity, but to

expand the area of verbal and word-thinking processes studied, selecting for psychophysiological analysis the substantive facts of language and speech singled out by linguistics. From the standpoint of our approach, the special element that was named internal speech in psychology was the most important in the mechanisms of speech. We have made an attempt to analyze here the physiological mechanisms of some phenomena of linguistic and verbal activity.

Chapter 2 deals with the mechanisms of such an important fact in organization of thinking and language as the meaningful and linguistic cohesiveness of words. It is demonstrated that so-called "interword temporary associations," i.e., the neural links established in the brain upon association of verbal stimuli, is the physiological basis of this fact. These associations of verbal stimuli are demonstrable in experiments with the use of various physiological techniques. Interverbal temporary associations form distinctive neural networks ("verbal networks") in the brain, which play an important role in organizing intraverbal [internal verbal?] processes.

Chapter 3 analyzes the mechanisms of formation and function of linguistic structures of a different level: mechanisms of separation into elements of a single verbal stimulus and subsequent synthesis of the separated elements. Such analysis and synthesis, which is performed by the nervous system, serves as the basis for formation and utilization of morphologically formed words, and this constitutes an extremely important aspect of vocal activity in inflected languages. Data on developing children's speech and, first of all, the distinctions of so-called creation of words by children are the most adequate means of studying mechanisms on this level. This phenomenon, which is well-known in psychology, yielded untraditional and very informative material for a conclusion as to the nature of second signal analysis and synthesis of vocal signals.

According to linguistic data, the morphological features of words are closely related to their use in a syntactic cohesive sentence. Studies of the distinctions of second signal analysis and synthesis of a speech signal made it necessary to include in the area of consideration the mechanism of syntactic connection of words, formation of sentences. Data on this subject are presented in Chapter 4. A hypothesis is expounded, according to which formation of special dynamic stereotypes is the basis for synthesizing words in a sentence. Theoretical conceptions are submitted concerning the possible mechanisms of syntactic operations. This chapter includes data on the experimental approach to this subject.

We realize that the work we are submitting for the reader's consideration reflects only the first steps in studies of the physiological mechanisms of complex speech phenomena. This is the reason for separation and different levels of some studies. Nevertheless, we were able to introduce into the range of psychophysiological analysis the central phenomena of vocal activity described in linguistics; the presence of linguistic and vocal [verbal] phenomena; the fact that man not only perceives but produces vocal sequences in the course of verbal communication.

The data of this study were gathered when this author worked at the Scientific Research Institute of General and Pedagogic Psychology, USSR Academy of Pedagogic Sciences, in contact with the Institute of Psychology, USSR Academy of Sciences, as well as when he worked at the Institute of Higher Nervous Activity and Neurophysiology, USSR Academy of Sciences.

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CSO: 1840/999

UDC: 612:577.3

ECOLOGICAL PHYSIOLOGY OF ANIMALS. PART 1: GENERAL ECOLOGICAL PHYSIOLOGY AND PHYSIOLOGY OF ADAPTATION, IN 'TEXTBOOK OF PHYSIOLOGY' SERIES

Leningrad EKOLOCICHESKAYA FIZIOLOGIYA ZHIVOTNYKH. CHAST' I: OBSHCHAYA EKOLOGICHESKAYA FIZIOLOGIYA I FIZIOLOGIYA ADAPTATSIY in Russian 1979 (signed to press 21 Apr 79) pp 2, 439-440

[Annotation and table of contents from "Ecological Physiology of Animals. Part 1: General Ecological Physiology and Physiology of Adaptation, in 'Textbook of Physiology' Series", edited by A. D. Slonim (editor-in-chief), Department of Physiology, USSR Academy of Sciences, Izdatel'stvo "Nauka", 3100 copies, 440 pages]

[Text] This book contains data from the literature and experimental material on problems of general ecological physiology. There is discussion of general problems and current status of this branch of physiology. Special attention is given to the general effects of natural environmental factors on the organism, problems of hibernation, torpid states and population physiology. There are 78 illustrations, 36 tables; bibliography lists 1467 items.

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10,657
CSO: 1840/999

UDC: 577.31

CIRCADIAN RHYTHMS OF BIOLOGICAL PROCESSES AND THEIR ADAPTIVE SIGNIFICANCE IN VERTEBRATE ONTOGENESIS AND PHYLOGENESIS

Novosibirsk SUTOCHNYYE RITMY BIOLOGICHESKIKH PROTSESSOV I IKH ADAPTIVNOYE ZNACHENIYE V ONTO- I FILOGENEZE POZVONOCHNYKH in Russian 1980 (signed to press 21 Dec 79) pp 2-3, 278

[Annotation, foreword and table of contents from book "Circadian Rhythms of Biological Processes and Their Adaptive Significance in Vertebrate Ontogenesis and Phylogenesis", by Gennadiy Dmitriyevich Gubin and Yefim Shmuylovich Gerlovin (deceased), Scientific Research Clinical Department of the Siberian Department of the USSR Academy of Sciences and Institute of Clinical and Experimental Medicine of the Siberian Department of the USSR Academy of Medical Sciences, Izdatel'stvo "Nauka", 1800 copies, 278 pages]

[Text] This monograph deals with the rhythms of biological processes on different levels of organization of living organisms, for the purpose of learning about changes therein in ontogenesis and phylogenesis. The role of biorhythms is shown in adaptation of vertebrates to changing environmental factors. Attention is given to mechanisms of regulating circadian rhythms on the cellular level.

This book is intended for biologists, physiologists, morphologists and physicians.

There are 40 tables; 64 illustrations; bibliography lists 799 items.

Foreword

At the present time, there has been an increase in interest in problems of biorhythmology, the methodological principles of which are confidently penetrating into studies of all levels of organization of living things. The tree of chronobiology is growing and becoming stronger, forming more and more new branches, which have practical importance (chronopharmacology, chronotoxicology, chronomedicine, chronohygiene, etc.).

It is becoming obvious that the problem of the effects of heliophysical and geophysical factors on man's adaptation processes are closely linked with problems of biorhythmology. By studying the circadian organization of biological systems, efforts are being made to analyze the definitions of "health," "premorbid state," "disease." Development of methods to assess the health status of populations that live under inadequate environmental conditions, development of bases for reliable forecasting of the health status of the public, make it necessary to use the chronobiological approach.

The vital functions of biological systems are characterized by the existence of stages and specific features in each period. In essence, we refer to the long-term coexistence of an organism in adequate and inadequate conditions. Is this associated with change in the known [or some] mechanisms of ontogenesis or do these mechanisms interact with another biological program determined by evolution, which is implemented in the presence of prolonged inadequate environmental conditions? Evidently, the genetic mechanisms and reserves of this program only interact with the ontogenetic program. Perhaps, certain changes in the hierarchy and formation of goals of a biosystem are provided to implement these programs. If we succeeded in finding the most limiting elements and means of implementing new, prolonged adaptive processes, it would be possible to correct them more effectively and predict the results of encounters between a biological system and inadequate conditions.

These pressing biomedical problems should be solved by investigating the distinctions of rhythms of biological forms of movement of matter from the broad general biological and evolutionary points of view.

However, there is still no systematic summary of studies of circadian rhythms of biological processes in the literature.... [incomplete sentence, end of foreword not available].

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UDC: 612.84+612.87

SENSORY SYSTEMS: TASTE AND SMELL

Leningrad SENSORNYYE SISTEMY. OBONYANIYE I VKUS in Russian 1980 (signed to press 2 Dec 80) pp 2, 179, 181-184

[Annotation, abstracts of articles and table of contents from book "Sensory Systems: Taste and Smell", edited by G. V. Gershuni (editor-in-chief), Institute of Physiology imeni I. P. Pavlov, Scientific Council for Complex Problems of Human and Animal Physiology, USSR Academy of Sciences, Izdatel'stvo "Nauka", 1700 copies, 184 pages]

[Text] This book consists of surveys and survey-experimental articles dealing with olfaction and gustation of vertebrates, as well as chemoreception in gastropod mollusks. Physiological and biochemical mechanisms of olfactory cell function, as well as significance of olfaction to the behavior of fish and amphibians, are discussed. There are experimental data on the distinctions of structural organization of the organ of taste; current conceptions are summarized on biochemical bases of reception of gustatory agents; some physiological mechanisms of function of the sensory gustatory system and behavioral aspects of taste perception are described. This publication is intended for specialists in the field of physiology and allied biological sciences.

Abstracts UDC: 612.861

"Physiological Mechanisms of Olfactory Receptor Cell Function," by A. V. Minor

Experiments involving recording of the electrooculogram and electrotonic potential of the olfactory nerve, as well as intracellular derivations of potentials from the olfactory epithelium, made it possible to investigate the properties of the olfactory receptor potential. The flagella are the main chemosensitive part of the olfactory cell. At the same time, there is experimental evidence of the fact that the area of active depolarization involves most of the membrane of the peripheral process. There is substantiation of a concept, according to which chemosensitive and electrogenic parts of the olfactory cell are spatially separated, and that there is an internal mechanism that provides for a connection between them. Estimates and experimental data indicate that the kinetic parameters of the olfactory receptor potential are not determined by diffusion of the aromatic substance in the layer of olfactory mucus, but by an internal intermediate process. This process includes a system for synthesis and breakdown of cyclic AMP, which plays the role of intracellular mediator in the mechanism of stimulation of the olfactory cell. Bibliography lists 55 items; there are 6 illustrations.

UDC: 612.86

"Properties and Functions of Olfactory Epithelium Proteins," by O. S. Gladysheva, D. M. Kukushkina and G. I. Martynova

On the basis of the authors' own data and the literature, information is submitted on the role of proteins in the receptor process of the olfactory organ of vertebrates. It was demonstrated that there is individuality to the protein composition of the olfactory lining in relation to tissues of a different nature. A change in activity of alkaline phosphatase was demonstrated under the influence of olfactory stimuli. There is comprehensive discussion of the functional role of this enzyme in various structures of the olfactory epithelium, involvement in processes of metabolite transport, cell differentiation, secretion, production of a supply of inorganic phosphate and possibly special functions in the process of reception of odors. Bibliography lists 80 items; there are 5 illustrations and 1 table.

UDC: 597.5:591.512

"Significance of Olfaction to Fish Behavior," by G. A. Malyukina, A. O. Kasumyan and Ye. A. Marusov

Questions of chemical communication of fish in intraspecies and interspecies correlations are discussed on the basis of the authors' own studies and numerous data in the literature. There is comprehensive discussion of the results of experiments dealing with recognition of fish of different species according to smell, as well as individual differentiation between specimens of their own species, identification of their own roe nests and offspring, choice of mate and determination of social status of a specimen of their own species. There is also discussion of the role of various receptor systems involved in perception of chemical stimuli. Much attention is devoted to the defense reactions of fish in response to chemical danger signals--alarm pheromone and scent of a predator. The ontogenetic time of appearance of these reactions is given; the influence of a number of biotic and abiotic environmental factors, physiological state of fish on intensity and nature of manifestation of defense behavior. There is discussion of the role of olfaction in formation of correlations between fish in populations and biocenoses. Bibliography lists 50 items; there are 59 illustrations.

UDC: 597.94:591.185.34

"Olfaction-Controlled Behavior of Caudate Amphibians," by S. E. Margolis

This survey deals with current conceptions of the role of olfactory signals in organizing food-procuring, mating, defense and orienting behavior. There is discussion of the significance of specific cutaneous glands of caudate amphibians as a source of olfactory signals, on the basis of which chemocommunication takes place during the period of mating behavior, and their role in defense behavior. Attention is called to the significance of olfactory signals as a function of

behavioral reactions and ecology of caudate amphibians, and in this reference the results are submitted of using original methods of investigating the olfaction-guided behavior of tritons. Bibliography lists 72 items.

UDC: 612.86

"Natural Amino Acids as Olfactory Stimuli in Some Amphibians," by N. B. Kruzhalov

According to data in the literature, amino acids are effective stimuli for the olfactory receptors of fish and chemoreceptors of aquatic invertebrates; the chemoreceptors of amphibians, fish and aquatic invertebrates are involved in food reactions; the olfactory receptors of amphibians and fish are morphologically similar. Using the method of recording electrical activity of the olfactory bulb, it was demonstrated for the first time that the olfactory system of frogs is sensitive to amino acids. Just as in fish, greater effectiveness of L isomers is inherent in frogs, as compared to D isomers, and greater effectiveness of amino acids than carboxylic acids. There is discussion of the distinctions of olfactory reception of terrestrial and aquatic forms of amphibians. Data concerning the functional properties of the accessory olfactory system are discussed, as well as the sensitivity of the vomeronasal organ to amino acids, which was demonstrated for the first time. Bibliography lists 66 items; there are 4 illustrations and 2 tables.

UDC: 612.65.87

"Study of Gustatory Structures of Vertebrates by the Method of Scanning Electron Microscopy, by T. M. Dmitriyeva, Z. V. Lyubimova and A. I. Yesakov

The authors submit the results of studies of structural organization of the ancillary system of chemoreceptor elements of the tongue in the comparative aspect. The distinctions of ultrastructural organization of various forms of papillae, their topography on receptor-bearing surfaces in the order of vertebrates are discussed: in fish--Baykal cisco and oil-fish; acaudate amphibians--the frog; and mammals--guinea pig, rat and cat. The nature of structural organization of papillae as related to dietary distinctions and the animals' habitat is discussed. Bibliography lists 28 items; there are 7 illustrations.

UDC: 591.487

"Some Evolutionary Distinctions in Organization of the Gustatory Organ of Fish," by R. A. Pevzner

This survey submits the author's and literature data on ultrastructural organization of receptor, supporting and basal cells of Elasmobranchii fish (carp, white amur, pike and others). It was demonstrated that fish retain the general principle of organization of the gustatory receptor: in all receptor cells there is a single microvillous process, well-developed smooth endoplasmic reticulum, synaptic contacts with nerve endings. Data are also submitted on the distribution and quantity

of taste buds as related to diet; there are fewest in predatory fish, in whom the gustatory receptors control the food swallowed, and the most are found in phytophages and benthophages, whose gustatory receptors can find the source of food. Data are also submitted about compensatory development of taste buds in blinded predators, blind cave fish and fish that live in murky or swift rivers. Bibliography lists 95 items; there are 5 illustrations.

UDC: 612.87+591.484/488

"Biochemical Aspects of Reception of Gustatory Agents in Animals," by R. N. Etingof and I. B. Ostretsova

Data in the literature and the authors' own material are summarized concerning the nature and properties of receptors that perceive sweet and bitter agents. It was demonstrated that the "sweet" receptors are of a protein nature, similar in properties in mammals and insects, which are localized in the membrane elements of the taste cell. There is discussion of the possible involvement of some enzymatic systems in the primary mechanism of the receptor process. In this respect, special attention is given to enzymes that are involved in conversion of cyclic nucleotides, as well as α-glucosidase of insects' sensillae. Bibliography lists 66 items.

UDC: 612.65

"Significance of Metabolic Reactions of Gustatory Receptors to Perception of Chemical Stimuli," by V. O. Samoylov, V. N. Solov'yev, N. G. Gurskaya and A. S. Gurchenok

A survey was made of data and conceptions developing and rejecting the enzyme hypothesis of gustation. Analysis was made of the methodological difficulties involved in solving this problem, and a new approach is validated for studying the role of metabolic reactions of taste receptors in perception of chemical stimuli. The results of experimental work on this score are summarized, and this enabled the authors to formulate their conception of primary mechanisms of taste reception. The hypothesis is expounded of heterogeneity of molecular mechanisms of perception of substances that have different taste qualities. Bibliography lists 78 items; there are 4 illustrations and 1 table.

UDC: 591.18,481:185.31

"Central Mechanisms of Function of the Sensory Gustatory System," by N. Ye. Vasilevskaya

A survey is offered of the current status of the question of central mechanisms of gustatory reception. Data are submitted on the morphology of the primary center in

different classes of vertebrates and representation of taste in the mammalian thalamus and cerebral cortex. There is discussion of the results of physiological studies of the gustatory system of mammals. Special attention is given to the results of studies of mechanisms of analysis and processing of gustatory impulses in the central nervous system of fish and amphibians. Data are submitted on studies of evoked potentials in the fish and frog medulla, and in the tapetum of the fish mesencephalon in response to stimulation of the afferent conductor of gustatory reception, reactions of neurons to adequate stimulation of taste receptors, as well as the results of studies of insturmental conditioned reflexes of fish directed toward restoring optimum conditions in the aquatic environment after adding chemical agents to it. Bibliography lists 54 items; there are 3 illustrations.

UDC: 612.833+612.391+612.86

"Taste and Behavior," by V. G. Kassil' and G. V. Makukhina

This survey deals with the significance of the gustatory analyzer in forming some behavioral reactions. Data from the literature are submitted concerning maturation of the gustatory analyzer in prenatal and postnatal ontogenesis. There is discussion of inborn reactions related to gustatory analysis and choice in eating and drinking behavior, as well as species-related distinctions of gustatory analysis related to the type of diet. There is comprehensive discussion of questions of change in gustatory choice with change in state of the endogenous environment of an organism and change in its requirements, on the example of attitude toward foods. Much space is devoted to conditioned reflex changes in attitude toward different flavors on the example of formation and retention of gustatory aversion. The authors' own experimental data are submitted, which deal with age- and sex-related distinctions of formation of gustatory aversion in albino rats. Bibliography lists 60 items; there is 1 illustration.

UDC: 612.821

"Individual Distinctions of Gustatory Sensitivity of Man According to the Results of Screening Tasters," by R. V. Golovnya, V. N. Yakovleva, A. Ye. Chesnokova, Yu. A. Borisov and A. V. Matveyeva

This article analyzes individual gustatory sensitivity of man. Of a total of 102 subjects, 16% were found to be "color blind" and 2% had heightened sensitivity to all four main types of flavor--acid, sweet, salt and bitter. Of the total, 80.7% of the subjects had heightened sensitivity for sweet flavor and 67.0% for salt. The subjects' sensitivity to different flavors diminishes in the following order: sweet, salt, bitter and acid. Using cluster analysis, a method was developed for screening [professional] tasters suitable for rating the pleasing qualities of foods. Introduction of an additional criterion made it possible to single out a more homogeneous group among the most sensitive and psychologically stable tasters for determination of the thresholds of taste and odor of individual compounds. Bibliography lists 36 items; there are 3 illustrations and 6 tables.

UDC: 591(481.4+181.381.5):594.381.5

"Osphradial Sensory System of Gastropod Mollusks," by V. A. Sokolov, N. N. Kamardin, O. V. Zaytseva and T. P. Tsirulis

A study was made of physiology and morphology of the osphradial sensory system of Lymnaea stagnalis. The cytoarchitectonics of the receptor epithelium and osphradial ganglia are described. Two types of endings of receptor neurons were demonstrated. It was found that the reactions of the fibers of the osphradial nerve to osmotic and chemical components of solutions differ in dynamic range and direction (increase or decrease in impulsation frequency). The correlation between frequency of impulsation and osmotic concentration of solutions is described by S-shaped functions. Representation of osphradial reception in the large parietal and visceral ganglia was demonstrated. Several forms of organization of interneuronal relations, which are involved in discrimination between osmotic and chemical components of a stimulus, as well as signaling to efferent systems, were demonstrated on the identified neurons of these ganglia. The physiological mechanisms and structural correlations between nerve elements on the visceroparietal level of integration of the osphradial sensory system are discussed. Bibliography lists 42 items; there are 7 illustrations.

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UDC: 612.825.5:612.882

MECHANISMS OF INTERACTION BETWEEN INTERNAL AND EXTERNAL ANALYZERS. VISCERAL AFFERENTATION OF BRAIN FUNCTIONS

Leningrad MEKHANIZMY VZAIMODEYSTVIYA VNUTRENNIKH I VNESHNIKH ANALIZATOROV in Russian 1980 (signed to press 8 Aug 80) pp 2-4, 149

[Annotation, foreword by Academician V. N. Chernigovskiy and table of contents from book "Mechanisms of Interaction Between Internal and External Analyzers. Visceral Afferentation of Brain Functions", by Vladimir Semenovich Raytses, Izdatel'stvo "Nauka", 1350 copies, 150 pages]

[Text] This monograph summarizes data from the literature and the author's own electrophysiological research on functional organization of central parts of internal (visceral) analyzers and mechanisms of interaction between visceral afferent signals and sensory messages going to the central nervous system from somatic, vestibular and visual receptors. Current data are submitted on involvement of the hypothalamic and limbic structures of the brain in central control of sensory processes and mechanisms of interaction between interoceptive and exteroceptive signaling. The significance of visceral signals to formation and expression of certain forms of emotional reactions and purposeful behavior is discussed, as well as emotional disorders in the presence of visceral pathology. There are 50 illustrations and 5 tables; bibliography lists 449 items.

Foreword

This monograph by Prof V. S. Raytses, which is small but has comprehensive contents, deals with a problem, which is important and still pressing, but still not resolved, that pertains to the correlations between two flows of signals, one of which informs the organism of man and animals about events in the environment and the other, about what is happening in the organism itself.

The importance of this problem, which retains its significance in our times, had already been appreciated by I. M. Sechenov. With reference to mechanisms of regulation, he wrote about so-called systemic senses [feelings]: "The vague overall feeling (probably from all organs of the body that have sensory nerves) is the general background for the diverse manifestations that apply here, which we call a sense of general well-being in a healthy man and a feeling of general malaise in a weak or sick one. In general, this background has a very strong effect on work performance, as well as man's mind, although it does have the nature of a calm, even, vague feeling. The healthy tonus of everything that happens in the body, which medical men refer to as vigor vitalis and that which is called spiritual mood in the psychological aspect depends on this feeling" (Sechenov, 1956, p 671).

In his monograph, V. S. Raytses summarized rather extensive material that he and his colleagues gathered, which deals with the problem formulated previously. Of special value in the monograph is the fact that it discusses comprehensively, knowledgeably and on the basis of facts, the interaction between signals traveling from various physiological systems of the organism to many branches of the central nervous system and, particularly, those that one generally refers to by the term "subcortical structures."

The author demonstrated convincingly that a signal coming from visceral elements not only has its own communication channels with the central nervous system (the existence of such channels is not questioned), but its own terminal "stations" in different parts of the central nervous system and, what is more important, that a signal arriving at these "stations" from visceral systems interacts with the one coming to the same places from the receptive fields of the musculocutaneous, vestibular and visual systems. It should be assumed that this continuous integration of signals on different levels of the central nervous system allows the human and animal organism, as an integral system, to perform behavioral acts.

The author made a good choice of the problem of interaction of afferent systems. Indeed, the receptive fields of the skin, like those of the eyes, give our body a clear idea about objects around us, and all effects directed to these fields reach consciousness without difficulty. Conversely, signals from the vestibular analyzer, which are, incidentally, very important for our spatial orientation, are not as easily and simply reflected in our consciousness. A man who has slipped or stumbled can correct the position of his body in space in an instant--with or without success--not because he clearly knows what he must do to maintain a vertical position. This happens, as they say, instinctively, without the involvement of consciousness.

Even vaguer are the sensations originating from muscles, which I. M. Sechenov called "dark, dim." For expressly this reason it is very important to determine how interaction of these very heterogeneous signals interact on different levels of the nervous system.

This work, which was done on a modern level using modern methods, is dedicated to the above problem. I believe that it will be studied with interest by physiologists; moreover, it will be useful to clinicians as well, particularly neurologists who will not regret the time they spent reading it.

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UDC: 575.4:577.4:591:612.014

ACCLIMATION OF ANIMALS

Leningrad AKKLIMATSIYA ZHIVOTNYKH ORGANIZMOV in Russian 1981 (signed to press 2 Dec 80) pp 2-6, 134-135

[Annotation, introduction and table of contents from book "Acclimation of Animals", by Vladislav Vil'gel'movich Khlebovich, edited by Ya. I. Starobogatov, Zoological Institute and Section of Chemicotechnological and Biological Sciences, USSR Academy of Sciences, Izdatel'stvo "Nauka", 1900 copies, 136 pages]

[Text] This book analyzes the phenomenology and mechanisms of acclimation of animals referable to different taxonomic and ecological groups to environmental factors, on the basis of a survey of the author's own data and those in the literature. Acclimation is compared to processes that are similar in duration (about 2 weeks) and mechanisms (gene regulation): some manifestations of ontogenetic development, immunity, neurological memory, compensation of injuries, etc. Practical acclimation procedures are described. Ecological and evolutionary aspects of this biological phenomenon are discussed. There are 49 illustrations, 9 tables; bibliography lists 417 items.

Introduction

If we were to conceive of the field of activity of science as very rugged terrain, in which we must see more and learn more, scientific theory can be mentally drawn in the form of an observation [watch] tower. We could endlessly fortify and build up the only "correct" tower, but we could build one, two or more new towers that would enable us to see new objects around us or to examine already known ones at a different angle or even from the opposite side. Probably, the "observation sectors" from different towers will overlap, and this would correspond to the situation where the same phenomenon can be examined using the armamentarium of concepts, terms and methods of different branches of sciences. Apparently, this is more a positive than negative element, although it does involve some difficulties of presentation of material, since the logic of facts leads the researcher through branches of science that are beyond his own narrow specialty.

In this book, we tried to consider from different angles the phenomenon of acclimation which, like physiological adaptation, adaptive modification, as an act of genetic regulation, as well as the method of determining the ecological spectrum, is found to be linked to various biological disciplines.

Historically, the concept of acclimation emerged in connection with studies of ecology of several species of marine animals. Studies of the temperature range of vital function of some fish revealed that the ranges for survival, reproduction or function of different systems of an organism depend on the temperature the animals were exposed to before the experiment and how long this exposure lasted (Sumner, Doudoroff, 1938; Stroganov, 1940; Doudoroff, 1942, 1945; Brett, 1944, 1946; Fry et al., 1946, and others). It thus became apparent that, when comparing the temperature reactions of groups of animals, they must first be kept under standard conditions (they should be acclimated to the corresponding temperature). Subsequently, this requirement was applied both to the study of species referable to other taxonomic groups and to work pursued to determine the effects on organisms of other abiotic environmental factors: salinity, hydrostatic pressure, light, pH, oxygen content, etc. (see, for example, the surveys by the following authors: Bullock, 1955; Prosser, 1955, 1977, 1978; Kinne, 1964, 1970, 1971; Zhirmunskiy, 1966; Hoar, 1967; Alderdice, 1972; Precht et al., 1973).

At the present time, acclimation is generally used to refer to a "compensatory change arising in an organism in response to prolonged deviation of some environmental factor (usually under laboratory conditions) from its original level" (Prosser, 1977, p 19). This definition of K. Prosser, in spite of its vagueness, is valuable in that acclimation is interpreted as a biological phenomenon, and not as a methodological procedure for obtaining material that is comparable in its physiological parameters.

There was the greatest interest in the study of temperature acclimation, since it is more universal and methodologically more accessible (see surveys by: Kinne, 1970; Alderdice, 1972; Precht et al., 1973; Wieser, 1973). There are somewhat fewer known works dealing with acclimation to salinity of marine organisms; however, information of a general nature is concentrated in them (see surveys by: Kinne, 1971; Khlebovich, Berger, 1975; Prosser, 1977, 1978). For several years, studies of acclimation of aquatic organisms to removal or addition of salt were conducted in our laboratory at the White Sea Biological Station of the Zoological Institute, USSR Academy of Sciences, paying considerable attention to osmoconformers, i.e., organisms incapable of osmotic regulation of their endogenous environment. In our opinion, these models have several advantages, and they should be discussed.

In the first place, marine organisms inhabiting shallow water, which is the source of osmoconformers for the corresponding experiments, have a particularly large phenotypic component of variability or, in other words, capacity for acclimation (Schlieper, 1964; Newell, Bayne, 1973; Oertzen, 1973; Mayr, 1974). Suffice it to recall that such properties of organisms as eurythermia and euryhalinity, which are so typical expressly of shallow waters, are related to the capacity for acclimation to temperature and salinity.

In the second place, apparently because salt water is not only the habitat but physiological environment for aquatic poikilosmotic organisms (= osmoconformers) (Henderson, 1924), one can examine the process of salinity acclimation of these animals with the use of various chemicals, adding the appropriate agents, for example, radioactive isotope-labeled precursors of synthesis of nucleic acids or protein, directly in experimental containers with salt water. No matter how complex the problem of permeability of substances through biological membranes

may appear, practice has shown that when the most diverse substances are added to salt water they penetrate rather quickly into the endogenous environment and cells of poikilosmotic organisms. This is probably related to the capacity, which was observed expressly in marine organisms, unlike fresh water organisms, to take up amino acids, sugars and other organic molecules by their body surface, extraintestinally, and include them in their metabolic processes (Stephens, Schinske, 1957, 1961; Stephens, 1964; Jorgensen, 1976; Sorokin, 1977).

Curiously enough, in the euryhaline Polychaeta Nereis limnicola, as ambient salinity declines uptake of glycine through the integument gradually diminishes, and it stops completely with chloride concentrations of less than 100 mmole/ℓ (Stephens, 1964), which corresponds to salinity of about $6^0/_{00}$, i.e., close to "critical salinity," which separates most fresh and salt water organisms (Khlebovich, 1974a). It can be assumed that these advantages of investigating acclimation on models of adaptation of salt water osmoconformers to desalinization or salinization can extend to similar studies of some endoparasitic helminths, for example, thorny-headed worms [Acanthocephala] (Mikhaylova, Khlebovich, 1976; Khlebovich, Mikhaylova, 1976).

It must be stressed that one generally uses acclimation to refer to both the process of compensation for environmental factors and the result of this process. One can assess acclimation according to compensatory changes in growth, metabolism, some forms of activity and, finally, resistance. Accordingly, many procedures are used to test acclimation. The tested signs are usually determined quantitatively.

In the study of acclimation phenomena, it is expedient to make a distinction between six pairs of variants thereof, which reflects to some extent the diversity of properties of acclimation, as well as methodological approaches to its study.

1. Acclimation against the background of ontogenetic morphogenesis and acclimation of definitive stages. The study of acclimation of developing individuals is particularly promising in ecology, since the parameters used to test compensation for factors (rate of development and growth, time of puberty and fertility) are extremely important base material for modern ecological efforts. Such an approach was recently used with success by G. A. Galkovskaya and L. M. Sushchenya (1978).

Studies of acclimation of definitive stages will have the advantage in defining the phenomenology and mechanisms of this process, since one must dissociate oneself strictly from morphogenetic processes related to individual development. Moreover, thanks to the anabolic (Severtsov, 1939) nature of acclimation of definitive stages, it is preferable to study them to solve acclimation-related problems of genetics and evolution.

2. Acclimation of conformers (for example, poikilosmotic and poikilothermic organisms) and regulators (homoiosmotic and homoiothermic organisms)--see Figure 1 [not reproduced].

3. Acclimation to the tolerable range of a factor, tested by the intensity of a physiological function (capacity adaptation) and resistance acclimation (resistance adaptation), tested by the number of surviving specimens after a certain period of exposure or during exposure inducing death of a specific share of specimens, for example, 50LT, 100 LT, etc. (see: Precht, 1958; Precht et al., 1973).

4. Organismic acclimation and cellular or tissular acclimation. Here, one should apparently make a distinction between resistance or tolerance of cells and tissues extracted from an intact organism that is in the process of acclimation or acclimated, from the situation where the cells and tissues themselves, isolated from the organism, are acclimated.

5. Acclimation of prokaryotes and eukaryotes.

6. Acclimation of unicellular and multicellular animals.

In this work, we shall dwell primarily on problems of phenomenology and mechanisms of acclimation of definitive stages of multicellular animals, conformers and regulators, in the tolerable range, on the level of the organism and the cell, as well as in comparison to protozoans (Chapters 1 and 2). The conclusions concerning ths fluctuating mode of function during acclimation, its duration and underlying mechanisms of biosynthetic activity of cells made it possible to compare acclimation to similar phenomena (Chapter 3), as well as to discuss from this vantage point some elements of ecology (Chapter 4) and evolutionary questions of appearance and transformation of a certain variability (Chapter 5).

Contents

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PHYSIOLOGY OF CIRCULATION. PHYSIOLOGY OF THE HEART, IN THE 'TEXTBOOK OF PHYSIOLOGY' SERIES

Leningrad FIZIOLOGIYA KROVOOBRASHCHENIYA. FIZIOLOGIYA SERDTSA, V SERII "RUKOVODSTVO PO FIZIOLOGII" in Russian 1980 (signed to press 13 Mar 80) pp 2-4, 593-598

[Annotation, foreword by G. N. Konradi and table of contents from book "Physiology of Circulation. Physiology of the Heart", in the "Textbook of Physiology" series, edited by N. I. Arronet, Izdatel'stvo "Nauka", 9850 copies, 598 pages, illustrated]

[Text] This book submits the principal data needed to understand the function of the heart and its different manifestations. General properties of myocardial cells, their ultrastructure, energy resources, generation of electrical potentials, electromechanical coordination and mechanism of contraction are discussed. Cardiac automatism and spread of excitation over the heart are described. The heart's pumping function, phases of its activity and results of studies of levels of cardiac output are submitted; there is discussion of the principles involved in measuring and recording the pumping function of the human heart. Data are submitted on mechanisms of regulation of cardiac function, the role of hemodynamic, innervation and hormonal influences on the heart, reflex control of its function. The key issues that are important to future studies are mentioned. There are 98 illustrations and 6 tables; bibliography lists 1306 items.

Foreword

Academician Vasiliy Vasil'yevich Parin (1903-1971) and Yevgeniy Borisovich Babskiy (1902-1973), active member of the Ukrainian Academy of Sciences, played an exceptionally large role in development of Soviet physiology of circulation. They played a leading role in conceiving the idea and planning of the volumes of this "Textbook," which deal with physiology of the cardiovascular system. V. V. Parin and Ye. B. Babskiy were teachers who trained researchers, a number of whom presently head large scientific teams. They were experts, not only in the branches of science in which they are to be credited with experimental research of major importance, but of physiology as a whole; they were able to combine work on basic problems with studies that had to be conducted because of the immediate needs of clinical practice and applied physiology. Everyone who was fortunate enough to know Vasiliy Vasil'yevich and Yevgeniy Borisovich gratefully remembers how valuable were their advice, fruitful critical comments, how meaningful was their assistance and cooperation in conducting research that they considered worthy of support. The

group of authors of this volume were constantly aware of the profound effect on its content of the passing of V. V. Parin and Ye. B. Babskiy; we should like for everyone who uses this book to find a stimulus and example for their efforts in the works of Ye. B. Babskiy and V. V. Parin.

Ye. B. Babskiy was the inspiration for the volume dealing with physiology of the heart. He made a general outline for this volume, essentially lined up the authors, and chapters 2, 5-9, 12-19, 23, 24 and 26 were written in accordance with his instructions and with his constant counsel. He was able to read over most of these chapters, to indicate some desirable refinements, and himself wrote a considerable part of Chapter 5, which contains the important results of his own research. Chapters 1, 3, 4, 10, 11, 20, 21, 25 and 27 were written after the death of Yevgeniy Borisovich, and he is not a party to the flaws they contain; but it is hoped that the general tenor of these chapters does not digress from his ideas and requirements.

Here, the discussion of problems of physiology of circulation is pursued exclusively in the aspect of normal physiology. Problems of pathological and clinical physiology of the heart, effects on it of environmental factors and pharmacology should be discussed in special publications. The chapter on coronary circulation will be published in the next volume, which deals with systemic hemodynamics, organic circulation and regulation of function of the cardiovascular system as a whole.

Special mention must be made of the nature of bibliography references, which are listed in a bibliography that covers all of the chapters. Of course, it would have been impossible to cite the entire relevant literature on any of the issues discussed in each chapter. The submitted bibliography has only the intent of listing mainly new sources, from which it is easy to retrieve a more complete bibliography on the subject. For this reason, the reader is referred, in most cases, not to the first works that established some thesis or other, but to subsequent publications containing data about prior research.

N. Ye. Babskaya was very helpful in compiling this volume; T. I. Khalevina helped in its final preparation for publication and compilation of the general bibliography; in addition to members of the editorial board, the following offered valuable advice on different chapters: V. Ya. Izakov, V. A. Levtov, S. N. Lyzlova, S. A. Regirer, B. I. Khodorov and V. N. Chernigovskiy. Many thanks to them.

Contents

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'MYOTON' UNIT FOR THE CONTROL OF MOVEMENTS

Kiev "MIOTON" V UPRAVLENII DVIZHENIYAMI in Russian 1980 pp 2-4, 142-143

[Annotation, foreword and table of contents from book "'Myoton' Unit for the Control of Movements", by L. S. Aleyev, M. I. Vovk, V. N. Gorbanev and A. B. Shevchenko, Izdatel'stvo "Naukova dumka", 144 pages].

[Text] This monograph describes a method of bioelectrical control of human movements and construction of programmed multichannel units of the Myoton type, in which transformed bioelectric potentials of muscles are used to control contractile activity of skeletal muscles. It was demonstrated that the Myoton is a result of development of electric muscle stimulators. There is a technical description of the unit, as well as of the method of practical operation thereof by an operator. The authors' experience with the Myoton used to "impose" principal movements on man is described.

The desirability and potential of using this type of unit are demonstrated, in conjunction with other therapeutic measures, for some disturbances of motor functions resulting from diseases of the nervous system.

This book is intended for physiologists, physicians, scientists concerned with biological and medical cybernetics, as well as engineers working in the field of biomedical instrument making.

There are 49 illustrations and 2 tables; bibliography is listed on pp 130-141 (243 items).

Foreword

This work deals with the question of practical use of a method of controlling man's motor functions on the basis of biocontrolled electrostimulation of muscles.

Man's motor function is one of the most complex and best developed functions, which were formed as a result of long-term phylogenesis. Motor commands formed in the cortex and other motor centers of the human brain on the basis of afferent information, which is received as a result of environmental factors, are processed numerous times, as they travel toward effector mechanisms--muscles--on different levels of the nervous system, and are transformed from the "general task of movement" into concrete commands.

In the definition of I. M. Sechenov, a significant part of external manifestations of cerebral function ultimately amounts to only one phenomenon, muscular activity. In other words, the process of man's interaction with the environment is largely expressed by movements.

The question of control of man's movements has drawn in recent years the attention of a wide range of specialists--physicians, physiologists, engineers. If we consider that, with all the diversity and extreme differentiation and complexity of human movements, they are implemented by a system consisting of only a few dozen muscles, as well as the fact that efficiency of muscular function is very high, the interest in comprehensive investigation of man's motor system becomes understandable and warranted.

Interest in controlling motor functions, or at least to influencing them to correct some pathological deviation or other, arose not only on the basis of purely scientific interest, but as a practical need. The importance of the problem of controlling motor functions is also related to the already existing possibility of using artificial control systems to restore and compensate for lost motor functions, as well as the need to render assistance in movements and conditioning of the muscles of a man under specific conditions (which arise, for example, in connection with the development of space exploration and studies of the world's oceans).

In the presence of some diseases of the nervous system, particularly those associated with impairment of motor function, electrostimulation therapy was and remains an inseparable element of the overal set of therapeutic measures. Direct stimulation of nerves and muscles for therapeutic purposes makes it possible to prevent muscular atrophy when there is absence or drastic weakening of motor functions, as well as to increase the force of muscular contractions, improve delivery of blood to muscles and other tissues. However, traditional methods of stimulation (pulsed current of different forms, diadynamic current, sinusoid amplitude and frequency modulated current) do not solve completely the problem of rehabilitating patients with motor disturbances.

At the present time, the main problem in the area of electrostimulation therapy of impaired motor functions is restoration with its help not only of the strength of involved muscles, but a lost motor skill, i.e., to obtain rather complex movements of the limbs, torso or head. In this respect, the use of bioelectric potentials derived from muscles, which carry information about movement, was an important stage in the development of electrostimulation therapy. We are not referring to the simple use of amplified bioelectric potentials as stimuli, but to the use of these potentials as factors that control the operation of the stimulator. In this case, the EMG [electromyogram] is transformed in order to gain information from it about movement, and the transformed signal is used to control the stimulating signal. Expressly this approach was implemented in the method of programmed, multichannel bioelectrical control of human movements, which was developed in the Department of Bioelectrical Control and Medical Cybernetics of the Institute of Cybernetics, Ukrainian Academy of Sciences, on the basis of which several control units of the Myoton type were created. Such units made it possible to turn to flexible control programs. The latter are formed on the basis of the characteristics of natural muscular contractions. In turn, the change to flexible control programs made it possible to impose movements on man that are close to natural ones with the use of the Myoton unit and, in the presence of pathology of motor functions, to augment the efficacy of rehabilitation,

The first experimental prototype of the Myoton unit was produced in 1965. Then experimental lots of the Myoton-2 unit were manufactured.

Since then, the Myoton has successfully undergone clinical trial in many USSR clinics and resorts, and in 1977 it was recommended by the USSR Ministry of Health for use in medical practice and series production.

We wanted to share with the readers of this monograph the experience we gained as a result of many years of research directed at development and practical introduction of devices for bioelectrical control of human movements.

Contents

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SLEEP AND MOTOR ACTIVITY--STAGES OF ONTOGENETIC EVOLUTION OF SUPRASPINAL MOTOR CONTROL IN THE HUMAN SLEEP CYCLE

Leningrad SON I DVIGATEL'NAYA AKTIVNOST'--ETAPY ONTOGENETICHESKOY EVOLYUTSII SUPRASPINAL'NOGO MOTORNOGO KONTROLYA V TSIKLE SNA U CHELOVEKA in Russian 1980 pp 2-5, 150-151

[Annotation, introduction and table of contents from book "Sleep and Motor Activity--Stages of Ontogenetic Evolution of Supraspinal Motor Control in the Human Sleep Cycle", by I. A. Vakhrameyeva, USSR Academy of Sciences, Institute of Evolutionary Physiology and Biochemistry imeni I. M. Sechenov, Izdatel'stvo "Nauka", 152 pages]

[Text] This book offers a survey of the present status of the problem of mechanisms of regulating movements in man in the continuum of sleep; it also submits the results of the author's experimental research on development of these mechanisms in early ontogenesis. Three stages of development of mechanisms of depression of spinal motor centers in human ontogenesis are singled out on the basis of analysis of the dynamics of reflexes on the spinal and bulbar level during the sleep cycle of premature and term neonates; their role in organizing adaptive behavior during the neonate period is discussed. Bibliography lists 494 items; 31 figures and 2 tables.

Introduction

> "... All our efforts are directed toward studying each function of the organism in the course of its inception, formation and individual development...." (L. A. Orbeli, "Selected Works," Moscow--Leningrad, Vol 1, 1961, p 436).

In the last 10-15 years, conceptions of sleep as an active, complexly organized process have been significantly augmented, not only due to the intensive accumulation of facts and generalizations dealing with neurophysiological and biochemical nature of sleep, but thanks to creation of the conception of motor control, directed toward active restriction of muscle tone and mobility during sleep (Pompeiano, 1966, 1967, 1976). The conception of Pompeiano, which is striking in its orderliness and argumentation, for which reason it was gained general recognition, not only hands over neurophysiological substantiation of many of the distinctions of sleep behavior, but can serve as the theoretical basis for studying pathological disorders that are based on selective impairment of supraspinal motor control (sleep-walking, talking in one's sleep, etc.). At present, it is no longer questioned that relative immobility and muscle relaxation, which are the typical signs of a sleep state,

do not reflect inactivity of higher motor centers; rather, to a much greater extent they reflect the activity of numerous mechanisms that limit conduction to effectors of an excitatory flow of impulsation traveling to the spinal centers over corticospinal and rubrospinal pathways, as well as afferent pathways of spinal reflex arcs.

Activation of the system of inhibitory motor control occurs chiefly at the stage of sleep that Jouvet (Jouvet et al., 1959) graphically called paradoxical, which is characterized by prevalence of heightened excitability and activity of higher motor centers, unlike the stage of slow-wave, or orthodox sleep. Thus, the basic hypnogenic processes that develop in the central nervous system when falling asleep and with the succession of stages of sleep constitute a sort of "switch" for motor functions, setting the system of regulation of movements to a new functional mode.

It is logical to expect that the formation in ontogenesis of man of the waking--sleep continuum was also associated with development of mechanisms of inhibitory motor control for spinal depression during paradoxical sleep. However, while the problem of formation of sleep stages in human ontogenesis is being studied in depth and comprehensively in many laboratories of the world, the question of ontogenetic evolution of mechanisms of inhibitory motor control during paradoxical sleep has not yet been investigated systematically. In essence, as we undertook the experimental study of dynamics of monosynaptic reflexes during daytime sleep of neonates, we only had the conception that supraspinal motor control is organized differently at the early ontogenetic stages than in adults, which was formed on the basis of data in the literature and our own concerning the distribution of motor phenomena during the sleep cycle of neonate infants and animals. Yet it is extremely important, from the standpoint of general biology, to comprehend the process of development of both different elements and the entire system of inhibitory influences on spinal centers during sleep, since this process reflects the general principle of evolution of inhibitory influences at the early stages of ontogenesis. In addition, one must take into consideration the circumstance that newborn infants spend most of the time sleeping, and 50-60% of total sleep time is referable expressly to paradoxical, or active sleep. On this basis, we can realize how great the share of mechanisms of inhibitory motor control in the general system of organization of the infant's adaptive, postural and motor behavior. Of course, this monograph does not presume to shed exhaustive light on this complex and pressing problem, let alone offer a solution. The author hopes that the experimental studies and generalizations, which are the subject of the third--main--chapter, will serve as an impetus for development of new work in this direction, which will undoubtedly be more refined from the standpoint of methods.

Questions of formation of the waking--sleeping continuum in early ontogenesis of man and development of mechanisms of organization of depression of spinal motor centers in active sleep are the subject of the chapter which discusses in detail the distinctions of distribution of muscle tone and movements in different stages of sleep of adult man, as well as mechanisms on which this distribution is based; much attention is given to discussion of the conception of Pompeiano and its relation to current conceptions of the genesis of paradoxical sleep. Such a section was needed, not only for the purpose of preserving the intrinsic logic of our presentation, but because this aspect of neurophysiology of sleep has been left virtually untouched in the Soviet literature, while the existing surveys in English (Gardner, Grossman, 1975; Pompeiano, 1976) are not readily available to the reader at large.

The experimental data described and generalized in the third chapter and, to a lesser extent, in the second, were obtained as a result of many years of research conducted at the neonate department of the Institute of Obstetrics and Gynecology, USSR Academy of Medical Sciences. It is my pleasant duty to express my appreciation to the management of that institute and to G. P. Polyakova, department head, for granting me the opportunity to conduct my studies there, as well as to scientific workers M. L. Finkel' and I. I. Yevsyukova who participated actively in the experimental work. I also wish to express by deep gratitude to my coworkers of many years standing, A. G. Kamenetskaya, T. G. Antonova, I. G. Antoshevskaya and N. K. Glukhova.

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PROBLEMS OF PHYSIOLOGY OF MOVEMENT

Leningrad PROBLEMY FIZIOLOGII DVIZHENIY in Russian 1980 (signed to press 17 May 80) pp 2-4, 213-216

[Annotation, foreword, abstracts and table of contents from book "Problems of Physiology of Movement", edited by V. S. Gurfinkel', Institute of Physiology imeni I. P. Pavlov, USSR Academy of Sciences, Izdatel'stvo "Nauka", 2000 copies, 216 pages]

[Text] This collection consists of 15 articles which deal with problems of central mechanisms of coordination of movements, interaction of supraspinal and segmental reflex mechanisms, coding of information about movement by receptors of the motor system and properties of muscle as the object of control in performing movement. The collection is intended for specialists in physiology and psychology concerned with problems of higher nervous activity and physiology of movement, as well as specialists in the field of industrial physiology and sports.

Foreword

Distinction of physiology of movement as an independent branch of physiology occurred in the 1970's. For a long time, having developed within the framework of biomechanics, industrial and sports physiology and engineering psychology, physiology of movement developed its own approaches and defined the subject of its investigation.

Purposeful movement is always performed in the form of an integral reaction of the body, involving both the numerous structures of the nervous system and other systems in this activity.

The wide diversity of possible methodological approaches to the problems contained in the range of interests of physiology of movement is attributable to the complexity of these problems.

Up to the mid 1960's, there was prevalence in physiology of movement of the cybernetic systems approach to the question of movement coordination, and in the next decade it was replaced by analytical directions. Within the framework of these directions, chiefly by methods of intracellular recording of evoked potentials, data were obtained on the structural and functional connections of different populations of neurons of the cerebellum, subcortical elements and cerebral cortex with neurons of the spinal cord, as well as about the projections of afferent elements of the motor system in different parts of the central nervous system.

In recent years, a trend has appeared in the worldwide literature to combine the strong points of the systems approach with the capabilities of analytical methods.

The problems that are being worked on the most intensively at the present time are related to determination of the patterns of regulation of different types of movement--rhythmic, following, precision and regulation of position as a special instance of movement; nervous control of different parameters of movement--force, amplitude, speed, direction of displacement; role of unconditioned reflex mechanisms in regulation of voluntary movement; supraspinal control of reflex mechanisms in regulation of movement; coding of information about position and movement by the receptors of the motor system; coding of motor commands by the nervous system; neural mechanisms of initiation, ongoing regulation and stopping movement.

To some extent, this collection sums up the results of work done in the laboratory of physiology of movement, Institute of Physiology imeni I. P. Pavlov, over the last few years, under the supervision of Prof N. A. Rokotova.

It would be difficult to exaggerate the contribution N. A. Rokotova made to development of the range of problems in physiology of movement. It was inherent in her to conduct innovative research, both in the area of theoretical formulations and development of methodological approaches. The untimely death of N. A. Rokotova was a great loss to our science.

The collection is made up of studies referable to the most important directions of physiology of movement. The problems raised by the authors of the articles are the key problems in comprehension of processes of formation and regulation of movement. There is no need to assess here the extent, to which they have been solved and what has yet to be accomplished.

It is hoped that this collection will be useful, not only because it describes the results of observations, but its general orientation in working on problems of physiology of movement, which is undergoing dynamic development.

Abstracts

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NERVOUS REGULATION OF MOTOR ACTIVITY

[Abstract of article by N. A. Rokotova]

[Text] There is discussion of information processing in muscle receptors and means of possible use thereof in the regulatory ring proposed in the hypothesis of N. A. Bernshteyn. It was shown that the length of a muscle, rate of change therein, start and end of extension are coded in the frequency of discharges of different types of muscular afferents. Influences from muscle receptors expressed in the segmental ring of control are coarser and more generalized than supraspinal influences. There are 11 illustrations; bibliography lists 28 items.

UDC: 612.763

PROGRAMMING AND FEEDBACK IN REGULATION OF RHYTHMIC MOVEMENTS SET BY EXOGENOUS SIGNALS

[Abstract of article by N. A. Rokotova]

[Text] A study was made of coordination of regulation of parameters of human motor activity on the example of following movements and muscular tension in an isometric

mode. The experimental results are interpreted as indirect evidence of existence of separate systems for the control of force, speed and amplitude of movement. There are 5 illustrations; bibliography lists19 items.

UDC: 612.763

ARE THERE 'STANDARD SCALES' IN VOLUNTARY CONTROL OF MUSCULAR TENSION?

[Abstract of article by N. A. Rokotova, N. P. Anisimova and Yu. T. Shapkov]

[Text] The hypothesis of existence of descriptions in the nervous system that could serve as standard scales in voluntary control of isometric muscular tension was tested in experiments on healthy subjects. Wide variability of initial and terminal tension, number of gradations and magnitude of build-up, correlation between results and testing conditions are interpreted as evidence of absence of standard scales. There are 3 illustrations, 1 table; bibliography lists 12 items.

UDC: 612.76

NONSPECIFIC NATURE OF SPINAL PREADJUSTMENT OF VOLUNTARY MOVEMENT

[Abstract of article by I. N. Krylov and N. A. Rokotova]

[Text] Experiments on nine essentially healthy subjects by the method of testing the latency period of voluntary movement with the H reflex showed that alleviation of motoneurons in the latency period of movement in response to an audio signal is related more to the activating effect of the sound proper than to events that prepare for the movement. When movement is triggered by a visual symbol no prior accentuation of the H reflex is observed. There are 7 illustrations; bibliography lists 22 items.

UDC: 612.833

REACTION OF NONSPECIFIC MOTOR ACTIVATION (STARTLE REACTION) IN MAN AND DEPENDENCE THEREOF ON THE STATE OF ATTENTION

[Abstract of article by I. N. Krylov, N. A. Rokotova and N. F. Suvorov]

[Text] Experiments were conducted on 40 healthy subjects to study manifestations of the startle reaction in man to stimuli of moderate intensity, as well as dependence of degree of reaction on attention. It was demonstrated that selective attention effectively attenuates the activating effect of any startle stimulus. The fact that changes in indicators of the state of different neuronal levels (cortical, pontomesencephalic, spinal) of this reaction occur in the same direction is tentatively interpreted as evidence of corticofugal inhibition of multisynaptic reticular formation of the stem and mesencephalon. There are 10 illustrations; bibliography lists 62 items.

UDC: 612.748:816

FREQUENCY OF IMPULSATION OF DIFFERENT MOTOR UNITS IN VOLUNTARY CONTROL OF ISOMETRIC MUSCLE TENSION IN MAN

[Abstract of article by D. Kozarov, N. A. Rokotova, Yu. T. Shapkov and N. P. Anisimov]

[Text] A new method of selective derivation of single motor unit activity was used to track the frequency of discharges in achieving maximum voluntary tension of the biceps brachii at four different speeds. It was demonstrated that there is a minimal correlation between magnitude of interimpulse intervals between the first four discharges and rate of development of tension. There are 4 illustrations, 2 tables; bibliography lists 8 items.

UDC: 612.831:834

STUDY OF CONVERGENCE OF INFLUENCES FROM AFFERENTS OF ANTERIOR AND POSTERIOR LIMBS ON MOTONEURONS OF THE LUMBAR REGION OF THE SPINAL CORD

[Abstract of article by V. D. Avelev]

[Text] A study was made of interaction between polysynaptic descending and segmental reactions to stimulation of afferents of the flexor reflex of anterior and posterior limbs of cats by the method of itnracellular recording and derivation of potentials from the dorsal surface in motoneurons of the lumbar spinal cord. It was shown that descending interextremital responses depress segmental and spino-bulbo-spinal reactions without appearance of visible inhibitory potentials in the motoneuron. Three periods of inhibitory influence were demonstrated: 7-15, 40-150 and 300-500 ms. The possible mechanisms determining a given duration of inhibition are discussed. There are 5 illustrations; bibliography lists 27 items.

UDC: 612.82,62-501.72

CONVERSION OF INFORMATION IN THE NEURONAL STRUCTURE OF A MODEL OF THE SPINAL LEVEL OF CONTROL OF MUSCULAR CONTRACTION

[Abstract of article by S. P. Romanov]

[Text] A neuron model operating on a real time scale, which permits reproduction of the nature of conversion of impulsation inherent in various types of neurons on the spinal level, is described. There is discussion of patterns of transmission of information in simple neuronal structures and methods of analysis of interimpulse intervals for individual neurons, which permit demonstration of direct and feedback connections between them. There are 9 illustrations; bibliography lists 5 items.

UDC: 612.833

TONIC VIBRATION REFLEX AND SUPRASPINAL CONTROL THEREOF IN MAN

[Abstract of article by Yu. T. Shapkov and V. I. Goryayev]

[Text] Experiments on healthy subjects showed that the reflex to standard vibrostimulation of the biceps brachii increases proportionately to the increase in voluntary

tension of the muscle. The results are interpreted as confirmation of the hypothesis that there is a variable coefficient of intensification in the servo circuit [loop] of the tonic vibration reflex. The hypothesis is expounded that this is implemented by supraspinal change in effectiveness of excitatory influences of Ia afferents on phasic α-motoneurons. There are 5 illustrations; bibliography lists 26 items.

UDC: 615.47

METHODS OF STUDYING PROPRIOCEPTIVE REFLEXES IN MAN

[Abstract of article by Yu. P. Gerasimenko and S. P. Romanov]

[Text] The authors describe a device for mechanical stimulation of mobile elements of the limb, which permits delivery of stimuli of graded duration and force. Experiments are described that examine EMG responses when reflex reactions are elicited by the effect of sudden removal and application of load on man's motor system. There are 7 illustrations, 1 table; bibliography lists 11 items.

UDC: 612.741+612.855

MECHANICAL TRANSFORMATIONS IN THE 'MUSCLE-MUSCLE SPINDLE' SYSTEM AND DISCHARGES OF SPINDLE AFFERENTS DURING EXTENSION OF MUSCLES

[Abstract of article by N. A. Rokotova, V. I. Zalkind and I. M. Gorbunova]

[Text] Experiments conducted on more than 500 deafferented muscle receptors of anesthetized cats examined the correlation between the responses of spindle receptors and state of extrafusal muscle and intrafusal muscle fibers, with which the receptor nerve endings come in contact. Several examples are given, where the same input signal can elicit different patterns of receptor discharges. Views are expressed about the correlation between mechanical force that builds up in the region of the terminals of the afferent under study. The characteristics of the discharges depend on the current state of extrafusal and intrafusal muscle elements during delivery of the stimulus. At the same time, units of different functional types may reflect differently the same input stimulus. There are 7 illustrations, 2 tables; bibliography lists 30 items.

UDC: 612.885

SENSITIVITY OF MUSCULAR RECEPTORS TO CHANGE IN STATIONARY MUSCLE LENGTH

[Abstract of article by V. I. Zalkind and I. M. Gorbunova]

[Text] There is discussion of conventional methods of assessing static sensitivity of spindle receptors, as well as the authors' and literature data concerning the distinctions of discharges of different receptors when detecting an unchanging muscle length. The responses of 360 tested receptors were processed using the following criteria: 1) range of muscle lengths that a given receptor detects, from the static threshold to 10 mm extension; 2) probability of increase in discharge frequency with increase in muscle length; 3) configuration of "length-frequency"curve and its position in a system of coordinates; 4) coefficient of regression when the "length-frequency" function is close to linear; 5) degree of

stability of interimpulse intervals expressed as a coefficient of variation. It was found that, when examining the discharges of several receptors situated in the same muscle, as well as when analyzing the responses of a large population of units from several experiments, one can always demonstrate a wide spectrum of responses, and this perhaps has a desynchronizing effect on central neurons. Many muscle receptors do not present static linear behavior, and it is difficult to describe the "length-frequency" function with coefficients of linear regression without resorting to oversimplification of the actual situation. There are 2 illustrations, 2 tables; bibliography lists 31 items.

UDC: 612.741

FUNCTIONAL MODEL OF A SKELETAL MUSCLE

[Abstract of article by S. P. Romanov]

[Text] A model of a muscle was executed on an analog computer, and it is viewed as a complex structural entity that not only performs motor functions, but is supplied with its own receptor system. The model takes into consideration the nonlinear characteristics of conversion of length and tension, change in plastic and viscous properties of muscle fibers during contraction, distinctions of formation of receptor potentials in muscle spindles and tendon organs of Golgi. The model of the muscle is the object of control when studying neuronal mechanisms of control of muscular contraction. There are 11 illustrations; bibliography lists 11 items.

UDC: 612.748:816

THREE-DIMENSIONAL CONDUCTION OF ACTION POTENTIALS AND RATE OF PROPAGATION OF EXCITATION OVER MOTOR UNIT FIBERS OF HUMAN SKELETAL MUSCLES

[Abstract of article by G. Dimitrov, N. Tankov and Yu. T. Shapkov]

[Text] Extracellular recording of action potentials of motor units of the human biceps brachii and flexor carpi ulnaris revealed nonuniformity of rate of conduction of excitation over muscle fibers constituting a unit. Maximum values were recorded in the region of myoneural synapses, which is attributable to the patterns of conduction of potentials in a three-dimensional conductor. However, the differences in rate of conduction in proximal and distal directions cannot be explained from this point of view. There are 4 illustrations, 1 table; bibliography lists 19 items.

UDC: 612.741

POSTACTIVATION POTENTIATION OF MUSCLE IN TETANIC CONTRACTION

[Abstract of article by N. P. Anisimova and Yu. T. Shapkov]

[Text] Experiments on the cat's triceps surae showed the potentiating effect of a preceding tetanic contraction on the next one. Maximum potentiation is manifested in the third-fifth contraction, with an interval of 3-5 min. In tetanic tension, the contractile reaction of the muscle to each stimulus in a series depends on the magnitude of interimpulse interval and number of prior stimuli. There are 6 illustrations; bibliography lists 32 items.

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UDC: 613.12(98+99)

MECHANISMS OF MAN'S ADAPTATION TO HIGH LATITUDES

Leningrad MEKHANIZMY ADAPTATSII CHELOVEKA V USLOVIYAKH VYSOKIKH SHIROT in Russian 1980 pp 2-8, 199

[Annotation, introduction and table of contents from book "Mechanisms of Man's Adaptation to High Latitudes", edited by Prof V. P. Kaznacheyev, academician of the USSR Academy of Medical Sciences, Izdatel'stvo "Meditsina", 200 pages, illustrated]

[Text] This monograph sums up extensive, but thus far scattered and contradictory data in the literature, as well as the clinical and experimental findings of the authors, who pursued prolonged and comprehensive studies of the distinctions of man's adaptation to high latitudes.

The "polar stress syndrome," which develops in man in the Extreme North is viewed as a multilevel process, which is based on biophysical patterns of interaction between the body and the environment, distinctive mechanisms of bioenergetics (activation of processes of free radical oxidation of lipids, depression of antioxidase enzymatic systems). On the level of the integral organism, this syndrome is manifested by changes in enuroendocrine regulation, diverse functional changes, which develop in phases and vary in biological importance from adaptive to pathological. Consideration of these data is important for short- and long-term forecasting of the health status of the inhabitants of the Extreme North and Siberia.

This book is intended for physiologists, pathophysiologists, biochemists, as well as physicians in different clinical specialties concerned with problems of man's adaptation to long-term extreme factors.

This book has 47 tables, 34 figures, 1 diagram; bibliography lists 358 items.

Introduction

Scientific and technological progress, which has radically altered the interaction between mankind and the environment, has posed several problems today, which cannot be solved apart from biology and medicine. We refer, first of all, to problems of urbanization, population growth, species-specific life span, diet, occupational diseases, etc. The main criterion of effectiveness of solving these problems is the health status of a population, and the overall term of man's active life can be considered the integral indicator of population health. For expressly this

reason, the very concept of "health" should be considered and defined as the process of preservation and development of biological and psychological functions, optimum efficiency [fitness for work] and social activity of man, ability to reproduce healthy offspring with maximum life span (V. P. Kaznacheyev, 1977).

Soviet public health, which is refining and developing the forms and methods of rendering therapeutic and preventive care to the public, is based on the achievements of medicine. Great strides have been made in our country in this field: under the 10th Five-Year Plan, availability of physicians will come close to the optimum standard--36 per 10,000 population, which totals 960,000 physicians. At the present time, there are 2.7 million physicians in the world, 893,000 of whom are in the USSR (A. F. Serenko, G. N. Sobolevskiy, 1978). According to the Program of the CPSU adopted at the 22nd Party Congress, the number of people covered by dispensary supervision is increasing annually. This is an important prerequisite for the change to universal dispensary care of our country's people. Refinement of all systems for preservation and development of health, preventive and therapeutic measures, and rehabilitation is impossible without prior theoretical work. The decree of the CC CPSU and USSR Council of Ministers, "On Further Improvement of National Public Health" (1977), mentions the need for searching for new forms of more effective interaction between science and practice.

In our country, much attention is devoted to development of polar health care, which is characterized by constant improvement of the material and personnel base of therapeutic and preventive institutions, with due consideration of geographic pathology in northern regions, broad use of preventive measures, which is the leading principle of Soviet medicine. As of 1972, there was an average of 28.9 physicians per 10,000 people and 102.4 paramedical workers in northern regions and national okrugs. As compared to 1965, the number of hospital beds in 1972 increased from 12.5 to 18.9 per 1000 population (11 beds in the RSFSR). At the same time, there were wider opportunities to render specialized medical care. Thus, in 1965-1972, there was a 90% increase in number of surgical and general medical beds, 36% increase in pediatric beds and 83% increase in otolaryngological beds (S. Ya. Chikin, B. M. Cheknev, 1975, 1978). Along with the development of large medical complexes (hospitals and polyclinics) with all types of specialized medical care, which are typical for the large cities in the North (Murmansk, Arkhangel'sk, Vorkuta, Noril'sk and others), a wide network of district hospitals and feldsher-midwife centers has been created in rural areas. At the present time, qualified specialized medical care is available to all of the inhabitants in the North of the USSR thanks to the existence of appropriate centers (hospitals, polyclinics, dispensaries) with trained personnel, modern resources for transporting the sick and injured (specialized motor vehicles and aviation service).

Studies of the effects of climate and geographic factors of the North on man is a tradition in our medicine. The following have made a particularly large contribution: G. M. Danishevskiy, I. S. Kandror, A. P. Avtsyn and V. V. Yefremov. Schools and scientific directions of medicogeographic investigation of the North were formed in such cities as Moscow (A. P. Avtsyn, A. P. Shitskova, V. V. Yefremov), Leningrad (N. N. Vasilevskiy, A. L. Matusov, I. F. Ryabinin) and Arkhangel'sk (N. P. Bychikhin, G. A. Orlov, N. P. Neverova, T. I. Andronova). In the last few years, this direction was developed in the North of our country (V. P. Kaznacheyev, N. R. Deryapa, K. R. Sedov, N. V. Vasil'yev, V. P. Lozovoy,

N. S. Motavkina and others). It would have been unrealistic to be successful with studies and development of the Extreme North of our country without the participation of a large army of Soviet physicians, and it would be impossible to exaggerate their heroic work.

Foreign scientists also played an important role in development of biological and medical problems of the North: Kh. Forsius (Finland), L. Linderholm (Sweden), K. Oygard (Norway), L. Caprio, B. Harwald (Denmark), O. Shefer (Canada) and many others. The international unification of efforts of scientists and physicians in the area of medicine of northern territories is the logical and mandatory condition, not only to refine preventive and therapeutic measures, but for progress in modern biology and medicine as a whole. This is indicated by the results of four international symposiums on polar medicine (Fairbanks (Alaska, 1968), Oulu (Finland, 1971), Edmonton (Canada, 1974) and Novosibirsk (USSR, L978).

One could formulate a number of important problems, in our opinion, that are related to the future development of biological and medical research in the European and Asian North: in the first place, a definition of the medicogeographic aspect of northern territories; in the second place, the distinctions of man's adaptation to live at high latitudes and means of correcting deadaptation changes; in the third place, the health status and morbidity structure of new arrivals and aborigenes of the North at the present time and how these indicators will change in the future; in the fourth place, the distinctions of clinical course of various pathological processes in man, principles of treating them and preventive measures; in the fifth place, pressing problems of organizing public health care in polar regions.

The solutions to these problems should include the following main directions: universal dispensary care coverage of the public and medical implementation of professional screening (roads to health); health-improving measures (resorts, sanatoriums, rest homes, recreation [rest] zones; system of measures for the development of physical culture and sports, optimization of working, living, recreational conditions, etc.); creation of medical complexes (hospitals, polyclinics, etc.).

Universal coverage with dispensary care should be directed toward detection of prenosological states in man by means of informative tests, with the use of computer technology.

In our opinion, from the standpoint of possible control of population health and condition of the environment, the conception of life support system is the most promising. It includes in-depth analysis of a number of subsystems involved in personal (social and biological) needs of man. A life support system is a complex of interrelated and mutually complementary socioeconomic, biomedical measures, which are differentiated in accordance with regional distinctions and are directed toward performing national economic tasks and providing for vital function of people in accordance with the Soviet life style, with maximum preservation and development of man's health, preservation and development of the environment (V. P. Kaznacheyev, 1978).

What is the correlation between health status, stress and pathology of man, population health and structure of population morbidity? There is reason to believe that the nature of this correlation is largely determined by the adaptation

process (I. V. Davydovskiy). The adaptation process is a special form of human vital function, to maintain and preserve man's health under inadequate environmental conditions, i.e., in conditions that do not conform with his phenogenotypic and psychosocial needs at a given time (V. P. Kaznacheyev).

Thus far, there is inadequate investigation of adaptation on all levels of organization of biological systems (population, organism, organocellular, etc.), although expressly adaptation processes constitute the key positions of both health and pathology. The qualitative distinctions of these processes determine, to a substantial extent, the symptomatology and evolution of modern human diseases in the North. Demonstration of the distinctions of the mechanisms of adaptation in the prenosological period could be one of the means of constructing a basically new classifications of human diseases. One should develop and introduce into practice untraditional principles aimed at detection of prepathological states by using current informa ion on the problem of human adaptation to the extreme conditions of the North, correlations between physiology (norm) and intensity of adaptive mechanisms and pathology in both an individual and the population as a whole.

The prospect of continued development, not only of biology, but medicine, lies in profound investigation of adaptation mechanisms in man. In the course of man's development of northern territories of earth for many generations, there was formation of mechanisms that determined development of the state of adaptation of various populations to the extreme factors of these regions. A study of the history of formation of adaptive mechanisms on all levels of social and biological process will help solve such extremely important biomedical problems as the problem of chronic stress, appearance of new forms of pathology and others.

The uniqueness and specifics of human diseases in polar regions, the distinctions of medical geography, epidemiology of infectious and noninfectious diseases create the prerequisites for deper and new understanding of the etiology and pathogenesis of the most widespread diseases, and they enable us to predict the appearance of possible pathology in the future.

Today, the North puts many biomedical problems to us, but it also helps us solve them. Thus, the study of the distinctions of atherosclerosis and ischemia in northern countries has already enriched substantially modern cardiology. In the North, there is, so to speek, "exposure" of certain weak elements of the defense mechanisms of the human body, which are concealed at central latitudes. For this reason, biomedical surveys of the inhabitants of northern countries could be interpreted in modern medicine as a natural, huge "historical experiment," which determines the viability of human populations under special, extreme environmental conditions. Underestimation of the results of this "experiment" could be costly to mankind. It is also necessary to bear in mind that the human populations that acquired special adaptive mechanisms with regard to certain extreme factors (for example, high latitudes) could be found to be more resistant or more vulnerable to numerous deleterious consequences of scientific and technological progress. For this reason, future medical surveys of the population of northern countries require a special approach, and they cannot always be planned by the same methods that are used with success at other latitudes. A new, deeper aspect, which is very important in the practical respect, of the problem emerges, that of similarity and differences in the mechanisms of onset and development of seemingly utterly similar diseases in different climate and geographic regions of earth.

The attention of scientists has been long since drawn to man's acclimatization to the North. The facts obtained at the present time deal mainly with physiological evaluation of man's adaptation to the rigorous climate and geographic conditions of the polar region. Much experience has been gained in the area of controlling avitaminosis and prevention of hypovitaminosis in the North. There is information concerning changes in neuroendocrine regulation. However, there has been a substantial change in the situation in the area of biology and medicine in the last 10 years. There has been a significant increase in methodological possibilities for studying the human body, our methodological approaches have changed and so have the criteria for evaluating the obtained material. For this reason, of course, many questions in the problem of man's adaptation to the North today require definition and many require further development. There has been extremely little study of metabolic changes; we still know very little about the cellular and molecular mechanisms of man's adaptation to the North. There are many contradictions in evaluation of functional changes in the endocrine system. Methodologically, there must be development of the question of the extent to which the state of man's adaptation to the North is unique and specific, what differences there are in the course of pathological processes and what their causes are. Much depends on the correct answers to these questions and, mainly, the approach to prevention and treatment of diseases in the North and, consequently, health of the population as a whole.

This monograph is a summary of the field studies of the staff of the Institute of Clinical and Experimental Medicine, Siberian Affiliate of the USSR Academy of Medical Sciences, whose data were obtained mainly from investigation of the Asian northern regions of our country, which are characterized by rigorous climate and geographic conditions. The submitted material enables us to consider the process of man's adaptation to the set of climatic and geographic factors of the polar region in different seasons, with due consideration of age, sex, life span in the North, dietary distinctions, etc.

The obtained results were systematized according to level of organization of the biological system. It was shown that, on the molecular and cellular levels, adaptive changes are characterized by intensification of reactions of free-radical oxidation of lipids with concurrent decline of their antioxidative activity. Fatty acid hydroperoxides, which are highly reactive, could lead to alteration of cell membranes and impairment of their functions. These findings were made from a study of human erythrocytes. These conceptions served as the basis of the concept of the "polar stress syndrome."

On the level of the organism, the most important element of adaptive changes is the change in regulatory mechanisms, primarily neuroendocrine ones. The organism changes to a different level of regulation, and some of the clinical manifestations of hyperadrenocorticism do not develop because of increased production of glucocorticoids and marked increase in level thereof in blood, but because of a decrease in concentration of the opposite hormone, insulin. Such a mechanism of regulation corresponds to a different type of metabolism--"northern metabolic type." There is a change in metabolism of protein, fats, carbohydrates; however, the chief sign is promotion of the role of lipids in energy supply for adaptive processes. There is also a change in metabolism of vitamins, macroelements and trace elements, with reduction of the renal barrier to some water-soluble vitamins. The demonstrated changes determine different "standards" for parameters of the

endogenous environment and different "standards" for man's food intake in the North (L. Ye. Panin, 1978).

Changes in natural reactivity, which determine the distinctions of inflammatory processes, their tendency toward a chronic course (chronic, slowly progressing forms of rheumatism, nonspecific inflammatory diseases of the lungs and others), occupy an important place in the adaptive alteration of the organism. Changes in external respiratory function and pulmonary circulation are associated with development of discrete respiratory insufficiency. Noninfectious diseases of the cardiovascular system (atherosclerosis, cardiac ischemia, essential hypertension) are characterized by a severe, continuously progressive course, and they usually strike young people of an employable age.

In this work, an effort was made to show that the distinctions of adaptive changes and course of pathological processes in man in the North should be considered from the same positions. Various approaches have been used to solve the formulated problems. The study of adaptive mechanisms in man was supplemented by experimental studies of animals.

The authors do not presume to have solved the problem definitively. Future studies will provide the fullest and most objective answer to all of the posed questions.

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HUMAN FACTORS

MAN UNDER EXTREME ENVIRONMENTAL CONDITIONS

Moscow CHELOVEK V EKSTREMAL'NYKH USLOVIYAKH PRIRODNOY SREDY in Russian 1980, pp 3-9, 190-191

[Annotation, English summary, foreword by Academician O. G. Gazenko and introduction from book "Man Under Extreme Environmental Conditions" by V. G. Volovich, Izdatel'stvo "Mysl'", 191 pages, illustrated]

[Text] Each year, thousands of scientific expeditions, exploring detachments, hunting parties and tourist groups travel to distant places--Arctic latitudes, taygas, arid deserts, dense jungles, seas and oceans. Not infrequently, they find themsevles in difficult and hazardous conditions, when both successful achievement of goals and life itself are threatened. This book systematizes the minimum amount of information needed for different natural conditions for the preservation of life and health in critical situations.

English Summary

This book was written aboard life-boats amidst stormy waves of three oceans, in frozen tents on drifting ice in the center of the Arctic, under unsteady tents in the burning deserts of Central Asia and beneath the sweltering cover of tropical forests. The author, a scholar in problems of survival, participated in many of the experiments in extreme natural conditions.

Travelers, tourists, geologists, navigators will come across numerous useful pieces of advice on how to survive and preserve one's health, if by chance they find themselves "face to face" with Nature: how to look for water in the desert, or build a temporary shelter out of snow, render help to people bitten by poisonous snakes and scorpions. They will learn about unfamiliar edible plants in the jungles, habits of sharks, of the worm palolo, poisonous mollusks of the tropical waters and many other things. A physiologist, biologist will get acquainted with the latest findings in studies concerning the state of human organism under different natural conditions.

The lucid language and numerous illustrations make the book an absorbing reading for everyone.

The foreword is written by academician O. G. Gazenko. The bibliography has over a thousand references.

Foreword

Relatively recently, at the start of our century, expeditions consisting of a small number of individuals tried to reach the North and South poles, persistently overcoming difficulties, and to conquer the peaks of the highest mountains. The history of these expeditions, many of which ended with the death of courageous travelers, constitutes a heroic chronicle. To this day, we cannot read about the attempt of Captain Scott to conquer the South Pole without experiencing much excitement. The history of this expedition, the death of all its participants, which is reflected in the sparse entries in the diary of Captain Scott and in his letters to relatives, the notes of his subordinates and comrades, just like the history of the expedition of the Russian Captain Sedov, who died in an attempt to reach the North Pole, constitute documents that elevate man, in spite of all their drama.

In the past, it was relatively rare to succeed in saving people, mainly travelers or scientists, who encountered troubles in remote geographic regions of our planet that were poorly adapted for human life. The technological revolution, whose contemporaries we are, the appearance of more sophisticated aircraft, helicopters, ships designed for specialized purposes, development of effective means of radio communication should, it would seem, have eliminated to a significant degree the acuteness of the problem of saving a man or group of people in the event of their exposure to the extreme conditions of a natural environment--in the uninhabited regions of the Extreme North, in remote desert regions, in dense tropical jungles and the vast expances of ocean waters.

Strange as it seems, but this is not so. Moreover, it can be stated that the problem of assuring the safety of man, even for short stays under such conditions, is a rather important practical task of our times. This is quite understandable, since there is no absolutely reliable equipment. Ocean liners sink, and hundreds of people find themselves in lifeboats or rafts in the ocean waves; aircraft have to make forced landings and, as a result, people find themselves under conditions that are extremely unsuitable as a habitat. Spacecraft also could, in emergency situations, land in virtually any region of the globe: in the jungles, desert, high mountains and expanses of the ocean.

For this reason, a new branch of medicine was formed in the last few years, which deals with problems of man's survival when left to himself in geographic regions of the earth that are extremely difficult to live in, in which it may be an unsurmountable problem to obtain fresh water needed for drinking, food, protection against sun rays or, on the contrary, against icy cold. To solve the problem of rescuing man from the above-mentioned extreme situations, it became necessary to study, both under laboratory conditions and in the field, the capacity of the human body to withstand life-threatening extreme factors and, at the same time, to start developing diverse means of rescue.

Having scientifically substantiated knowledge about the latent reserves of the body, which enable man to fight actively against the deleterious effects of various extreme environmental factors for a certain period of time, the researcher can derive a rather valuable conclusion both about the optimum strategy of a man's behavior under such conditions and about the most effective means of helping him.

In the book offered to the reader, all these interesting problems are discussed for the first time in a popular form by a scientist who conducted such studies for over 25 years, actively and with much enthusiasm. The author, V. G. Volovich, is one of those rare specialists who has his own rich experience in studying problems of man's autonomous existence in different geographic regions.

V. G. Volovich started his scientific work with studies of man's self-contained existence in the Arctic. He was the physician in scientific expeditions on the drifting North Pole-2 and North Pole-3 stations, the work of which gained broad recognition. He is to be credited with some serious medical investigations during self-contained existence on various vessels in the tropical zone of three oceans. He also headed and was directly involved in the difficult and, at times, hazardous studies directed toward investigating the possibility of autonomous existence in the deserts and jungles. V. G. Volovich summarized in this book his many years of fruitful work in this new branch of medicine, in situations where a man has to strain to the utmost his will, mobilize all his strength for wise adjustment to and struggle with extremely difficult natural conditions. He succeeded in telling the reader in a fascinating form about the most serious aspects of the problem of "man in an extreme habitat." The reader will glean from this book some valuable scientific information about the distinctions of vital functions of the human body under difficult climate conditions; he will learn about the experiments conducted by Soviet scientists on the problem of survival in different geographic zones, about wild edible plants in jungles and deserts, about poisonous snakes and methods of protection against sharks, about catching fish with poisonous plant substances and many other things; he will receive much useful advice, about how to behave under conditions of autonomous existence, how to orient himself, build a shelter, find water and food, render first aid, etc.

One need not question the fact that readers in the most varied professions will read this book with interest and will benefit from it.

Introduction

The thirst to learn about the environment is one of the powerful moving forces in man. This is what compels a man, in spite of incredible difficulties and deprivation, to strive toward the poles of our planet, to climb, risking his life, the highest mountain peaks, descend to ocean depths and volcano craters, and to assault cosmic space.

Untiring geologists search for underground treasures; explorers blaze new trails in the tayga and deserts; seafarers and fishermen channel their way through the blue expanses of the ocean, while the restless tribe of tourists travels on distant trips over beaten and unbeaten paths.

It would seem that, in our times of the technological revolution, when numerous and diverse means have been developed for protection against the deleterious effects of high altitudes and low temperatures, when the technical sophistication of air and marine transport assures man's safety in flight and on the water, while the means of communication make it possible to send a signal for help from any point on our planet, travelers, seafarers and land explorers could not be threatened with the tragic fate of Georgiy Brusilov and Vladimir Rusanov, Robert Scott and John Franklin, Solomon Andre and Roald Amundsen.

But, no matter how far technological progress has advanced, the arctic snowstorms have not grown warmer, hurricanes are still striking in their force, ocean storms and typhoons have not grown kinder, and the arid heat of the desert is still just as pitiless.

And it happens at times, that circumstances put man in a critical situation, one on one with nature.

One can read in the worldwide press about seamen who have been shipwrecked and found themselves on boats and rafts in the raging ocean, about fishermen carried out to open sea on fragments of icebergs, about wayfarers beset by a violent snowstorm, about tourists who have lost their way in the tayga or desert. Not infrequently, before help comes, the victims of a disaster must survive on their own, i.e., on their limited suply of food and water, using the available life support gear.

A good outcome of autonomous existence depends on many factors: physical and mental state of people, supply of water and food, effectiveness of emergency gear, etc. (Figure 1 [not reproduced]).

The environment, its physicogeographic conditions, is important to man's vital functions when he is on his own. By actively effecting the human body, it prolongs or shortens the time of autonomous existence, helps or prevents survival. Environmental factors that affect man are quite diverse and numerous. They include temperature and air humidity, wind, solar radiation and many others.

The arctic regions and the tropics, mountains and deserts, tagya and ocean--each of these natural zones is characterized by its own distinctive climate, topography, plant and animal kingdom. They determine the specifics of vital functions of a man who finds himself in one of these regions: his behavior, means of securing water and food, building a shelter, nature of diseases and means of preventing them, moving about the locality, etc.

However, the degree of importance of each factor is determined by the geographic location of a region.

For example, in the desert, the prime factors will be those directed at protection from heat and finding water; in the Arctic, fighting against the cold moves to the fore; in the jungles, people should strive, first of all, to prevent tropical diseases, etc.

Experience shows that people are capable of enduring the most rigorous natural conditions for a long time. However, a man who is not accustomed to such conditions and who is exposed to them for the first time, by chance, due to circumstances, is much less adapted for life in an unfamiliar environment than its permanent inhabitants.

For this reason, the more rigorous the environmental conditions, the shorter the period of autonomous existence, the greater effort is required to fight against nature, the stricter adherence there must be to rules of behavior, and the costlier each mistake that is made.

To survive, man requires certain conditions: food, water, shelter, etc. At the same time, being a member of society, he is accustomed to the idea that many of his needs are furnished by people around him, that someone is constantly concerned about meeting his needs, that he can always count on someone's help in any unfavorable situation. And indeed, in everyday life, man does not have to rack his brain over how to find shelter from the heat or cold, how and where to slake his thirst and hunger. If he has lost his way in an unfamiliar city, he will have no trouble finding the needed information, and if he gets sick he can turn to physicians for help.

In the case of autonomous existence in an unpopulated region, such a mundane philosophy developed by civilization is utterly unacceptable, since meeting even the most ordinary vital needs sometimes becomes a problem that is difficult to solve. In spite of experience acquired over many years, man's life begins to depend on very different factors (solar radiation, force of wind, ambient temperature, presence or absence of sources of water, animals, edible plants), rather than the customary criteria (education, professional skills, financial status, etc.).

The favorable outcome of autonomous existence depends largely on a man's psychophysiological traits: will, decisiveness, collectedness, resourcefulness, physical conditioning, endurance and others. But not infrequently, these factors alone are not enough for survival. People die of heat and thirst without suspecting that there is a life-saving source of water within a few steps; people freeze in the tundra because they were unable to build a shelter out of snow; they die of hunger in a forest teeming with game; they fall victim to poisonous animals because they do not know how to give first aid for bites.

The ability of man to survive is the basis for success in fighting against the forces of nature. Survival means active, purposeful action, applying one's knowledge, experience and inventiveness, using the available gear and means at hand with utmost effectiveness for protection against the deleterious effects of environmental factors and to meet the body's needs for water and food.

The main postulate for survival is that man can and must preserve his health and life under the most rigorous physicogeographic conditions if he is able to make use in his interests of everything that his surroundings have to offer.

But, certain theoretical knowledge and practical experience are needed for this. When starting out on a distant journey, man must have an idea about the physicogeographic conditions in the area of his proposed expedition: about the topography and sources of water, plants and animals, climate factors that could have an adverse effect on the body (cold, heat, solar radiation and others), the distinctions of these effects and methods of protection. He must learn to orient himself by the stars and other natural phenomenon, to identify edible plants, to make a fire without matches or lighters and to prepare food without dishes.

Diversified information gained in the course of learning and practical skills that are acquired not only will help fight the difficulties that arise for some reason or other, but increase a man's confidence in his strength, convince him that he will be able to cope with any adversity, since he will know what has to be done and how to do it.

For an untrained man, the environment seems to be the source of all sorts of hazards. He is in a state of constant anxious stress, since he does not know where to expect the danger from and, even if he does know, he cannot correctly assess its degree.

Such a state may last from minutes to many days, and the less informed a person is about the conditions that circumstances placed him in, the longer it lasts. Thus, an equally important objective of education is to psychological train a man to overcome a potential emergency situation, increase his emotional and volitional stability, teach him to properly understand and assess the existing situation and to act accordingly.

Still, no matter how well trained a man could be in methods of life support under conditions of autonomous existence, no matter how sophisticated his gear, the length of time, during which the body can withstand high or low temperatures, lack of water and food depends on the speed of alteration of physiological functions, severity of disturbances thereof and reversibility of processes.

The capabilities of the human body, like those of all living things, are limited and fit into a rather narrow range. What is this range? Where is the threshold, beyond which changes in functions of organs and systems become irreversible?

What is the time limit that people may have under specific extreme environmental conditions?

How can one slow down processes of dehydration or cooling, overheating or desalination? How can one extend the permissible time of self-contained existence, postpone the fatal hour?

Scientists go to the Arctic and deserts, to the tayga and ocean in order to answer these questions, which are posed by life,in the real situation, as close as possible to the conditions of autonomous existence.

This book deals with problems of survival of man, who finds himself under conditions of autonomous existence in different physicogeographic regions of the globe. It is based on the results of studies on this problem, which the author obtained during expeditions to the Central Polar Basin, the drifting stations, North Pole-2 and North Pole-3, in experiments in the field conducted in the polar Kola region, in the tropical zone of the Pacific, Indian and Atlantic oceans, in the Kyzylkum Desert and jungles of South-East Asia.

The author made an attempt to summarize on these pages Soviet and foreign knowhow in the area of survival, which was gained in the last decades, as well as to analyze and describe current views on different issues related to this problem, including the physiological essence of processes occurring in the human body under the influence of deleterious environmental factors.

The objective of the book was not only to acquaint the reader with the basic principles of human behavior during autonomous existence on land and in the ocean, but to help with practical advice on what one should do and how to do it under such conditions, making use of everything that the surroundings offer to preserve health and life.

Contents

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AIRCRAFT AERODYNAMICS: DYNAMICS OF LONGITUDINAL AND LATERAL MOVEMENT

Moscow AERODINAMIKA SAMOLETA: DINAMIKA PRODOL'NOGO I BOKOVOGO DVIZHENIYA in Russian 1979 pp 4-7, 348-349

[Annotation, foreword and table of contents from book "Aircraft Aerodynamics: Dynamics of Longitudinal and Lateral Movement", by G. S. Byushgens and R. V. Studnev, Izdatel'stvo "Mashinostroyeniye", 352 pages, illustrated]

[Text] This book deals with the distinctions of stability and controllability of longitudinal and lateral motion of modern aircraft. It submits the results of studies of pilot rating of piloting characteristics of an aircraft as related to its aerodynamic and inertial characteristics. It discusses the main directions of automation of control of aircraft by the pilot, including questions of automation of control of an aerodynamically unstable aircraft.

This book is intended for engineering and technical personnel, and scientific workers in the aircraft industry.

Foreword

In the last few years there has been substantial development of investigation of problems of flight dynamics, which is related to the desire to improve the reliability and safety of flights, improve flying characteristics of aircraft and, ultimately, to increase the efficiency of their use.

Optimum introduction of automation for aircraft control by a pilot plays a significant role in refining aviation technology. At the present time, it is virtually inconceivable to discuss aircraft dynamics without concurrent analysis of problems of automation of control, particularly analysis of systems for improving stability and controllability in manual control. Such problems as piloting an aircraft when performing various maneuvers made it necessary to conduct deeper studies of interaction between the aircraft and pilot, as well as to work out a mathematical description of pilot work.

Wide use of automated control is related to the possibility of malfunctions and need to develop differentiated requirements for different flying conditions. In particular, with each subsequent malfunction of devices in the control system, some worsening of its characteristics is permissible provided that safety of the flight is ensured.

Finally, there has been particular development in recent years of studies on special flight simulators ["piloting stands"], with a system for viewing the external situation, mockup of pilot's cabin with all the necessary flying instruments and controls. Equations of aircraft movement are solved on electronic computers. In the most modern flight simulators with movable cockpit, there is approximate reproduction of accelerations and other sources of sensations of flight to which a pilot is exposed.

Such simulators play a rather substantial role in studies of the dynamics of modern aircraft. The work done in the USSR and abroad with the use of such simulators yielded vast material for choosing parameters of the aircraft that determine stability and controllability, parameters of the control system, dynamics during vigorous maneuvering, in take-off and landing modes, etc. Studies with the simulators realize a savings in material and reduce substantially the time for development [finalizing] an aircraft.

In spite of the rather extensive literature dealing with various aspects of dynamics of flight and questions of automation of control, the above issues have not been studied comprehensively enough or covered sufficiently in the literature.

Investigation of different problems related to aircraft flying requires a different degree of accuracy of description of dynamics thereof. When analyzing the motion of an aircraft exposed to minimal perturbances and control actions, one can separate the equations of spatial movement into equations of longitudinal and lateral movement, and study them separately.

In those cases where perturbances or controlling actions are sizable, one must consider spatial movement and analyze nonlinear equations [14]. Finally, in order to study the distinctions of aircraft dynamics when certain parameters of motion exceed the permissible ranges of change therein, one must examine the so-called critical flying modes (such as stalling, spinning, etc.), and this usually requires analysis of virtually complete equations describing aircraft movement.

In this book, analysis is limited mainly to examination of the patterns of aircraft movement, where linearization of equations is permissible and one can consider longitudinal and lateral movement separately.

In writing this book, the authors pursued the following objectives:

1. To summarize the main results of investigations of properties and distinctions of aircraft dynamics under traditional conditions of movement with minimal perturbances.

2. To discuss the pilot's rating of flying characteristics of an aircraft as related to dynamic characteristics thereof and the methods of studying such relationships on flight simulators, as well as some of the specifications for such simulators, ensuing from the desire to obtain a semblance of simulating flight.

3. To discuss the means of automation of manual control of modern aircraft that are being developed in recent years, for the purpose of improving flying characteristics of aircraft, as well as some questions of automating control of an aircraft, the aerodynamic configuration of which was optimized to improve flying characteristics.

All of the material in the book is divided into four parts.

The first part is introductory, to some extent. It gives the equations for aircraft movement and simplification thereof for solving different problems of dynamics, mathematical description of processing of piloting an aircraft by a pilot, methods of simulating flights on flight stands and some of the specifications for the construction thereof.

The second and third parts deal with problems of longitudinal and lateral aircraft movement, respectively, as well as the distinctions of dynamics and analysis of requirements pertaining to flying characteristics.

Finally, the fourth part deals with problems of automating manual control of an aircraft by a pilot.

The authors wish to express their appreciation to the following individuals, who were very helpful in making estimates and analysis of some problems contained in the book: Yu. A. Vinogradov, Yu. B. Dubov, V. I. Kobzev, A. V. Novikov, V. A. Serovatskiy, S. N. Suprunenko, V. M. Shibayev and others.

The authors wish to thank V. K. Svyatodukh, doctor of engineering sciences, and M. A. Tayts, doctor of engineering sciences, Honored Scientist and Engineer of the RSFSR, who reviewed the book, for their valuable comments about the manuscript.

Contents

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METHODOLOGICAL AND TECHNICAL PROBLEMS OF EXPERIMENTAL PSYCHOPHYSIOLOGY

Moscow METODICHESKIYE I TEKHNICHESKIYE VOPROSY EKSPERIMENTAL'NOY PSIKHOFIZIOLOGII in Russian 1980 (signed to press 13 Aug 80) pp 2, 90-95

[Annotation, abstracts and table of contents from book "Methodological and Technical Problems of Experimental Psychophysiology", edited by V. G. Volkov, candidate of engineering sciences, Izdatel'stvo "Nauka", 1500 copies, 95 pages]

[Text] This collection contains data on the study of the characteristics of an operator during simulation of various conditions of operator work, as well as on development of psychometric equipment for tests.

It is intended for specialists in the field of engineering psychology--psychologists, physicians and engineers.

UDC: 621:612.8*

EFFECT OF DURATION OF JOINT WORK ON EFFICIENCY THEREOF

[Abstract of article by V. A. Bodrov and I. Ye. Doroshenko]

[Text] A study was made of the efficiency [or effectiveness] of joint experimental work as related to different duration of such work. The main task for the subjects consisted of tracking for 20 min, against the background of which one of four additional tasks was presented three times for 15, 45 and 180 s: "Instrument dials," "Scale of vectors," "Time reflex" and "Sensorimotor reaction of choice." The greatest decline of efficiency of tracking was noted when it was associated for 15 and 180 s with the "Instrument dials" and "Scale of vectors" tasks. The change in efficiency of performing the additional tasks in these same segments of time occurred in different directions, and it was determined by the psychological structure of problem solving. The results of these studies are interpreted from the positions of the conception of P. K. Anokhin concerning the "exclusiveness" of mental activity and the dominance theory of A. A. Ukhtomskiy. There are 2 tables; bibliography lists 10 items.

ELECTROENCEPHALOGRAPHIC CORRELATES OF OPERATOR RESISTANCE TO STRESS

[Abstract of article by L. P. Grimak, L. G. Dikaya and O. M. Salmanina]

*Translator's note: UDC number is the same for all abstracts and is not repeated.

This article discusses the results of modeling various types of operator stress with the use of hypnosis. The simulated states are differentiated from emotions and fatigue on the basis of EEG data; the EEG parameters of operator resistance to stress are described. There are 2 illustrations; bibliography lists 5 items.

CHANGES IN TRACKING FUNCTION WHEN OPERATOR USES THE METHOD OF MENTAL REGULATION

[Abstract of article by Yu. F. Isaulov and N. N. Lebedeva]

[Text] This article describes the results of experiments testing the effect of one of the methods of mental self-regulation, autogenic training [biofeedback?], on tracking function when the operator works at a forced pace. There are 2 illustrations; bibliography lists 3 items.

IMPROVED QUALITY OF DETECTION OF VISUAL SIGNALS UNDER THE INFLUENCE OF FEEDBACK FROM PARAMETERS OF THE OPERATOR'S NICTITATING REACTION

[Abstract of article by Ye. P. Sviridov]

[Text] This study deals with the effect of delivering stimuli to an operator over the feedback chain from the parameters of the subject's nictitating reaction [corneal reflex?] on effectiveness of detection and tracking of randomly appearing visual signals under conditions of prolonged monotonous work. The obtained data indicate that there is a decrease in signal detection time under the influence of stimulation, increase in level of wakefulness of the operator, manifested by changes in physiological parameters of his functional state. A difference was demonstrated in the dynamics of parameters of operator performance during work, as well as a difference in their susceptibility to the influence of stimulation. There are 3 illustrations.

FUNCTIONAL SHORTAGE OF TIME IN OPERATOR WORK

[Abstract of article by Yu. B. Pikovskiy and L. S. Khachatur'yants]

[Text] This article submits a functional systems analysis of changes in quality of automated activity in modes of discrete-continuous and continuous tracking when operators are tired. Specific mistakes are described, which are inherent in each type of tracking, and the principle is expounded of functional shortage of time as the main condition lowering operator efficiency [fitness for work]. The possibility is discussed of enhancing the functional resistance of an operator by methods of purposeful psychological design of activity as it relates to adverse environmental factors. There are 2 illustrations; bibliography lists 2 items.

EFFECT OF REFRACTIVENESS OF THE VISUAL ANALYZER ON RELIABILITY OF OPERATOR PERFORMANCE IN A SYSTEM OF VISUAL OBSERVATION

[Abstract of article by O. O. Ryumin]

[Text] This article submits the results of studies of the effect of refracting capacity of the visual analyzer on reliability of operator performance dealing with visual observation under conditions simulating the work of cosmonauts as it relates to rendezvous and docking operations. As shown by the studies,

the reliability of performance is lower in operators with hypermetropic eye refraction than in emmetropes and myopic ones, since they develop fatigue faster. It is concluded that it is imperative to have equipment conform with the physiological capacities of the human visual analzyer, and to use operators with emmetropic and myopic refraction for such tasks, as well as to develop special work and rest schedules to provide high efficiency. There are 2 illustrations; bibliography lists 2 items.

A METHOD OF FUNCTIONAL DESIGN OF ACTIVITY

[Abstract of article by N. A. Luzhbin]

[Text] The method is based on successive transformation of the goal of activity [work] into the tangible level of its performance and processing of a number of unchanging characteristics of activity. Four levels of transformation were singled out: goal, plan, functional scheme and material [tangible] execution, which constitute precise models of man's reflection of future activity, and each successive level is the material carrier of the preceding one. Activity is viewed as a functional system, while the route over the levels constitutes retrieval and execution of system components. A symbolic description is given of the content of the levels and retrieval [search] strategies in terms of the desired changes in parameters of activity.

DYNAMICS OF SOME PHYSIOLOGICAL FUNCTIONS DURING 10-DAY HYPODYNAMIA WITH REPRODUCTIVE SUGGESTION OF HYPERGRAVITY AND HYPOGRAVITY STATES

[Abstract of article by A. A. Alelyukhin and M. L. Khachatur'yants]

[Text] This article describes the results of measurement of simple motor reaction, muscular endurance, tremor, critical fusion frequency and "tamping [typo for tapping?] test in operators submitted to hypodynamia for 10 days. All of the operators were divided into three groups: control, group with simulation of hypogravity and group with simulation of hypergravity. In the course of the experiment, there was demonstration of substantial differences in dynamics of all three groups of subjects according to the first three methods (simple motor reaction, muscular endurance, tremor). No changes whatsoever were demonstrable with regard to critical fusion frequency and "tamping test." There are 5 illustrations; bibliography lists 4 items.

EFFECT OF FATIGUE ON SOME PARAMETERS OF VERBAL COMMUNICATION

[Abstract of article by N. A. Yerashchenko]

[Text] Studies were made of the effect of fatigue on the quality of verbal instructions and some temporal characteristics of verbal flow, which occur in communication between speakers (operators). It was shown that these parameters may be a good indicator of changes in the psychophysiological state of an operator in the course of prolonged operator work. There are 2 illustrations; bibliography lists 2 items.

SOME DISTINCTIONS OF DYNAMICS OF EVOKED POTENTIALS DURING INTELLECTUAL ACTIVITY

[Abstract of article by G. M. Chernyakov]

[Text] Acoustical vertex potentials (VP) were recorded on subjects while reading texts, the form of presentation of which differed in difficulty of perception. A marked variability was demonstrated for single VP recorded successively in the course of one test. An effort was made to group the single VP's according to amplitude and configuration. On this basis, it was possible to distinguish several types of acoustic VP's in each subject. When changing from simpler to more complicated texts, the different types of VP presented a different tendency with regard to changes in their components. A change in one of the isolated types of VP showed a correlation with difficulty of the text. There are 3 illustrations; bibliography lists 9 items.

METHODS FOR STUDYING GROUP OPERATOR PERFORMANCE

[Abstract of article by N. N. Lebedeva and Yu. B. Pikovskiy]

[Text] This article describes the methods used to study the process of formation and execution of sensorimotor skills in interaction between two operators to perform the common task of tracking specified trajectories. There is also a description of the apparatus and equipment base for the experiments and methods for mathematical analysis of the results. There is discussion of the possibility of using these methods to study problems of group operator compatibility, alternating leadership and stability of group skills with complication of working conditions. There is validation of the methodological novelty of this approach and its difference from conventional methods of studying group operator activity. There are 2 illustrations; bibliography lists 4 items.

UNIT FOR RECORDING MEAN FREQUENCY OF NEURONAL ACTION POTENTIALS

[Abstract of article by S. N. Kozhechkin and V. S. Golichenkov]

[Text] An electronic device is described, which is intended for recording ongoing mean frequency of neuronal action potentials. The digital unit is assembled from integral microcircuits and contains, as its main elements, an impulse counter and code-voltage converter. The operating principle of this unit consists of counting input impulses over successive fixed intervals and conversion of the obtained binary code into voltage. The range of frequencies of input signals is from 0.1 to 1000 Hz. This unit permits recording information on inertial automatic printers. There are 3 illustrations; bibliography lists 7 items.

ANALOGUE DEVICE FOR COMPLEX EVALUATION OF TIME PARAMETERS OF THE REACTION OF INTERACTING OPERATORS

[Abstract of article by V. G. Volkov and V. I. Kichkin]

[Text] This work describes a device designed to measure sensorimotor reaction time of operators in a simulated conflict situation. By virtue of inclusion of a logic unit, specially developed for our purposes, in this device, it was possible to analyze this physiological characteristic, both with regard to its absolute values and several important derivatives, i.e., to assess the quality

of operator performance according to a given parameter, as well as to relate the outcome of the conflict situation to finer mechanisms of sensorimotor activity. There are 2 illustrations; bibliography lists 5 items.

CIRCADIAN RHYTHMS OF OPERATOR EFFICIENCY

[Abstract of article by Ye. A. Ivanov]

[Text] A description is given of the methods and results of experimental studies of efficiency [work fintess] levels of an operator in the course of continuous work for 3 days. Reliable circadian cycles of theses levels were demonstrated. The periods, amplitude and phases of cyclic changes in efficiency level were found to differ for different forms of activity. A link was found between level of efficiency and autonomic system parameters. There are 2 illustrations; bibliography lists 5 items.

DYNAMIC CORRECTION OF PARAMETERS OF A CONTROL SYSTEM WITH AN OPERATOR

[Abstract of article by M. V. Frolov]

[Text] There is discussion of adjustment of control system parameters to the existing psychophysiological state of an operator, on the example of a tracking complex. Adjustment is made dynamically to enhance the quality of tracking system operation as a whole. There are 3 illustrations; bibliography lists 5 items.

STUDY OF TRANSIENT CHARACTERISTICS OF RESPIRATORY REGULATION OF ELECTROCARDIOGRAM T WAVE AMPLITUDE

[Abstract of article by G. B. Milovanova]

[Text] This article discusses the effect of respiratory regulation on amplitude of the T wave. The transient characteristics of T wave amplitude obtained in experiments are given; there is discussion of questions of mathematical description thereof. There are 2 illustrations; bibliography lists 3 items.

INSTRUMENT FOR GRAPHIC RECORDING OF ARTERIAL PRESSURE

[Abstract of article by R. P. Kolokolenkina and I. V. Larin]

[Text] This article deals with a portable instrument for recording arterial pressure on one of the recorder's channels by the auscultative method. This instrument permits graphic documentation of arterial pressure in complex examination of functional parameters of patients' cardiovascular system in the case of long-term observation. There are 3 illustrations; bibliography lists 4 items.

PHYSICAL MODEL OF ASSOCIATIVE ENTRIES AND REPRODUCTION OF INFORMATION

[Abstract of article by A. A. Frolov, S. A. Gusainov and Ye. V. Serbina]

[Text] This work deals with a description of a physical model of simple associative memory, which refers to a functional device capable of reproducing a previously recorded complete information code upon input into the unit of any significant part thereof. The experiment conducted with this model confirmed the

feasibility of technical execution of some of the main principles of associative information processing in the nervous system. There is 1 illustration; bibliography lists 12 items.

EFFECT OF FATIGUE ON SPEED AND ACCURACY OF IDENTIFYING TONAL SIGNALS

[Abstract of article by V. G. Volkov, A. K. Yepishkin and V. A. Shilova]

[Text] Summary results are submitted of experiments dealing with the dynamics of efficiency [fitness for work] determined discretely in the course of 72 hours of continuous operator work. There are 2 illustrations; bibliography lists 5 items.

STUDY OF PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF AN OPERATOR IN A STATE OF EMOTIONAL STRESS

[Abstract of article by A. K. Yepishkin and V. A. Shilova]

[Text] Data are submitted on changes in level of efficiency caused by operator stress in ground-based simulation of space flight conditions. The results of the test of tracking discrete tonal signals revealed wide individual differences in direction and magnitude of the parameters studied. There are 2 illustrations; bibliography lists 5 items.

Contents Page

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VIDEOTERMINALS IN INFORMATIONAL INTERACTION (ENGINEERING PSYCHOLOGY ASPECTS)

Moscow VIDEOTERMINALY V INFORMATSIONNOM VZAIMODEYSTVII (INZHENERNO-PSIKHOLOGICHESKIYE ASPEKTY) in Russian 1980 (signed to press 23 Oct 80) pp 2, 200

[Annotation and table of contents from book "Videoterminals in Informational Interaction (Engineering Psychology Aspects)", by Valeriy Fedorovich Venda, Izdatel'stvo "Energiya", 8000 copies, 200 pages, illustrated]

Text] This book deels with principles in engineering psychology for the choice and use of videoterminals, optimization of the structure of informational interaction between man and computers in solving different problems of an operational, managerial, planning and design, and scientific research nature. Methods are described for mathematical modeling of processes of informational interaction. Special attention is given to methods of upgrading videoterminals and their practical use in developing and refining automated control systems.

It is intended for specialists in the field of automated control systems, computer and information technology, engineering psychology, ergonomics, scientific organization of labor and management [control].

Contents

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CURRENT ASPECTS OF ADAPTATION

Novosibirsk SOVREMENNYYE ASPEKTY ADAPTATSII in Russian 1980 pp 2-9, 191

[Annotation, introduction and table of contents from book "Current Aspects of Adaptation", by V. P. Kaznacheyev, USSR Academy of Sciences, Siberian Department, Scientific Research Clinical Section, Institute of Clinical and Experimental Medicine, Izdatel'stvo "Nauka", 192 pages]

[Text] This monograph deals with theoretical problems of human adaptation, work on which is gaining special importance. Scientifically substantiated recommendations to safeguard and develop the health of man (population) in different climatic-geographic and industrial conditions are needed in view of the development of new regions of our country that were previously not inhabited, and creation there of industrial production complexes. The correlation between processes of adaptation and pathological states is explored in this book. Some principles are expounded for diagnosis of different human states; their significance is analyzed with respect to prenosological dispensary care of the entire population and early prevention of disease. The main directions of research on man's adaptation to the Extreme North and Siberia are discussed.

This book is intended for biologists, physiologists, hygienists and physicians.

There are 24 tables and 28 illustrations. Bibliography lists 540 items.

Introduction

The development of the national economy of our country and of vast new territories, especially in regions with rigorous climate and geographic conditions, as well as with specific and insufficiently studied endemic, bacterial-viral and parasitic infections, introduction of new industrial technology, urbanization processes (North, BAM [Baykal-Amur Mainline Railroad] region, mountains, deserts) and other consequences of scientific and technological progress have altered appreciably processes of interaction between man and the environment. The formed biogeocenoses, psychophysiological properties of modern human populations, structure and nature of diseases are changing. The qualitative changes in biological and psychophysiological parameters of a modern population are characterized by development of new biological and general pathological patterns, the specific direction thereof under given climate, geographic and socioindustrial conditions.

The socioindustrial and hygienic aspects of life support systems are gaining increasing significance in the effectiveness of preventive measures. From the

practical point of view, of great importance are the works of A. L. Chizhevskiy and V. I. Vernadskiy about the biosphere, noosphere, problems of regional and global ecology.

Analysis of the physical condition of the inhabitants of eastern parts of our country, some mountain regions, the arid zone and seas shows that a significant part of the new arrivals and indigenous population are in a state of chronic stress. With the ever increasing shortage of manpower, growth of labor productivity, faster pace of production and life, the task that advances to the fore is not only to predict onset of diseases and premature aging, but to safeguard and develop the health of present generations, as well as to assure the health of future generations.

Man and human populations, ethnic, biological and psychophysiological patterns, changes in the environment, processes of technogenesis and noospherogenesis, noocosmogenesis are becoming problems of paramount importance in modern natural science, not only because the study thereof discloses more and more the capabilities of science in all areas, but because of their first and foremost practical significance to society. The modern scientific and technological revolution, the transformation of historically formed natural conditions over vast territories of earth and water, and the profound changes in the biosphere have advanced the problem of "man and the environment" among the ranks of pressing and priority problems, and the interdependence of these processes on earth to the level of problems on a global scale. Solution thereof is acquiring an increasingly acute sociopolitical aspect.

Among the elements of the current problem of man and the environment, one of the basic ones is adaptation, for which several major international programs have been developed intensively in the last few years. Many-year studies of man's adaptation to extreme conditions, within the framework of an international biological program, have been completed (1964-1974). The results of the research of Soviet scientists have been published in the periodic press and a special three-volume monograph (Z. I. Barbashova, N. G. Rychkov, M. M. Mirrakhimov, N. N. Sirotinin, N. R. Deryapa, A. L. Matusov, F. F. Sultanov, N. P. Neverova, T. I. Andronova, N. N. Mikloshevskaya, I. I. Likhnitskaya and others). A major contribution to development of this problem was the publication of the collective monographs, "Society and Human Health" (1973) and "Philosophical Problems of Adaptation Theory"(1975) edited by G. I. Tsaregorodtsev. Theoretical and clinical aspects are discussed in the works of V. V. Parin, A. P. Avtsyn, G. M. Danishevskiy, A. M. Chernukh, F. Z. Meyerson, M. M. Mirrakhimov, A. D. Slonim, Z. I. Barbashova, I. S. Kandror, N. R. Deryapa and L. Ye. Panin.

Four international symposiums on physiology and pathology of human adaptation to the North were organized and convened (1967 in Alaska, 1971 in Finland, 1974 in Canada and 1978 in the USSR), and the work of Soviet scientists was highly rated there.

Important basic and applied aspects of man's adaptation to the North were discussed at the Fourth International Symposium on Polar Medicine (Novosibirsk, 1978).

The key patterns determining good health, adaptation and pathology of the individual could not be properly understood apart from population and ecological categories. Man as a biosocial being is still part of the biosphere, upon which he depends by

virtue of the cycle of matter and energy and which (now as a social being) man transforms more and more actively, performing tremendous biogeochemical work that became the basis for formation of the noosphere (V. I. Vernadskiy, 1977).

The pace at which new environments to man were developed to meet the pressing needs of society is mounting constantly. A graphic example of this is the present national economic development of eastern and northern regions of our country. The scale of anthropogenic changes in the environment related to man's endeavors is well known (Ye. K. Fedorov, 1972, and others). This type of change is important to biologists, not only from the standpoint of environmental pollution or exhausting vital natural resources, but as a process of active formation of a qualitatively new, more complex environment, in relation to which man as a biological species has no inherited stereotype mechanisms of adaptation.

Modern human populations can no longer be viewed as conservatively stable groups that are constantly isolated, for generations, in the space they developed. Rather, these are continuous streams of people migrating over geographic space in a complex interweaving of social, industrial and natural conditions. The high migratory mobility of the population (Ye. D. Malinin, A. K. Ushakov, 1976, and others) is becoming a consistent phenomenon characterizing one of the most important aspects of socially determined adaptation of modern populations. This distinction is particularly prominent today in Siberia, the Extreme North and Far East, i.e., in regions where the share of region developed by man is growing intensively.

These circumstances, namely, the rapid modification of the habitat, ever increasing variegated heterogeneity of biotic and physicochemical properties of the biosphere (particularly in connection with urbanization, as well as industrialization of agriculture), migratory mobility (long- and short-term) related to new industrial development of previously uninhabited regions and intensification of microevolutionary changes in man himself, make it virtually impossible for any stable relations to become established between man and the environment.

In the terminology of E. Bauer (1935), it can be stated that man's correlations with the environment today are characterized by an ever increasing degree of stable imbalance, which is maintained by a constant and intensive adaptation process.

One of the scientific directions of our times, which is able to take into consideration all of the above-mentioned phenomena without overlooking processes and factors essential to human health, is to systematically accumulate knowledge in human ecology, i.e., a new scientific direction that goes substantially beyond the framework of demography, hygiene, medical geography, etc.

The health status of the individual and population is a derivative of social anthropo-ecological interactions. It is growing more and more apparent that there is a need for development, aside from purely medical issues, directions that are related to the study of ecological patterns, in particular, human ecology, a new interdisciplinary direction dealing with the patterns of interaction of human populations with environmental factors, development of population growth, preservation and development of health, refinement of physical and mental capacities of the Homo sapiens species. We refer to determination of the patterns of interaction between large population groups and the environment, who are arbitrarily called a population because of their socioindustrial, cultural and biological common elements. Even now, we can single out such patterns for the population of

large territorial-industrial complexes of the polar region, some permanent settlements of this region, stations in Antarctica and other territories, and, finally, the inhabitants of the European and Asian North as a whole. In spite of the significant arbitrariness of such distinction, this approach makes it possible to examine the most common and basic patterns of preservation and development of health, with consideration of the specifics of all climate-geographic and socio-industrial conditions.

It must be stressed that the concept of health of a single man (individual) and the conception of health of a population are referable to different levels of organization of society, although they are interrelated and mutually determined. Thus, the health status of the individual can be defined as the process of preservation and development of his mental, physical and biological functions, his optimum fitness for work and social activity with maximum (active) life span. Health of the population is the process of sociohistorical development of psychophysiological and biological viability of the population, continuity of generations with the ever increasing pace of social production, improved resistance of the population when developing new territories. According to these definitions, we see that, along with criteria of the health status of an individual, appropriate processing and generalization of which yields important information about the health of a population, it is imperative to single out additional indicators reflecting the state of the population as an integral whole. Analysis of anthropo-ecological patterns could be one of the most effective means of finding these indicators.

It is expressly in the aspect of anthropo-ecological patterns that one can gain deeper and more exact understanding of the process of adaptogenesis in the diversity of its individual and population manifestations.

Analysis of the ecological population aspects of human adaptation leads us to interpretation of population health as a process of sociohistorical development of viability (biological and psychosocial) of the population over a number of generations, with increasing fitness for work and productivity of social labor, refinement of species-specific properties and characteristics.

Along with the individual properties of individuals that make up a population, the criteria of the latter's health status include the birth rate, health status of offspring, genetic diversity, adaptation to climate and geographic conditions, readiness to play diverse social roles, age structure and others (A. M. Merkov, 1973; M. S. Bednyy, 1972; B. Ts. Urlanis, 1973, and others).

Such are the main current aspects of adaptation and anthropo-ecology of man, the scientific and practical significance of which would be difficult to overestimate.

In 1973, our work, "The Biosystem and Adaptation," was publsihed; it contains generalizations of a theoretical nature and expounds some theses concerning the routes of future study of the problem. We considered it to be a working program for the future. Since then, many of the problems described in that book underwent experimental and clinical development. New and original factual material was accumulated in the scientific sections of the Siberian Department of the USSR Academy of Medical Sciences, but the results of this research was published in fragments. Yet, the ever increasing scientific attention given to this problem, its practical importance to various areas of public health and the national economy are indicative of the need for continued work on the issues. Our intent was not to shed monographic light on all parts of the problem, the current literature on

which is enormous. This book contains mainly facts obtained during the period of expeditionary studies of the scientists of the Institute of Clinical and Experimental Medicine, Siberian Branch of the USSR Academy of Medical Sciences. Some sections deal with debatable issues. This is understandable, since studies of the problem as a whole began, as we indicated above, relatively recently. Exploration and development of the Extreme North, eastern regions and various extreme zones of our country, and urbanization are taking place so intensively that life is posing more and more new problems.

Consequently, it is all the more necessary to unite and cooperate, to make better planning of complex special-purpose programs with a tie in with other problems of scientific and practical importance. We also believe that the new data submitted here may be of practical significance, both to scientific organization and national economic planning.

Adaptation is unquestionably one of the basic qualities of living matter. It is inherent in all known forms of life, and it is so universal that it is sometimes equated with the very concept of life (H. Selye, 1972). And this is not by chance, since both the processes of inception of life, wherever they occur, and its evolution bore adaptive properties. The latter, being a mandatory attribute of life, grow more complex and progress as life develops, acquiring an increasingly active and, sometimes, self-suppressing nature. If the evolutionary process is viewed as the progressive development of adaptation to the environment and the property of adaptation of this environment in the interest of living things, indeed the concept of life and the concept of adaptation do overlap substantially.

Apparently, it is not by chance that the extremely important concept of "health norm" is defined as "... the optimum state of a living system in which *maximum* (italicized by V. K.) *adaptability* is provided (V. V. Parin, 1973). In the light of the theory of P. K. Anokhin (1975) concerning the anticipatory reflection of reality by living systems, his conceptions of functional systems, telenomic processes of vital functions and processes of adaptation are also united. In the course of evolution of species, there was selection and reinforcement in individuals of both functional and morphological mechanisms of adaptation, and new properties of functional organization of endogenous and exogenous adaptation processes, which determined the future advantages in survival of individuals, preservation and development of the species (population). The "health norm" of a living system formulated by V. V. Parin (1973) is determined by these properties of adjustment and adaptation with their discrete maximum capacities.

Similarly to the fact that the properties of individual development are invested in the genetic system while knowledge of the traits borne by genetic structures can only be gained when they are expressed in individual life (ontogenesis), the properties of adjustment and adaptation, i.e., the trait, the individual "health norm" can be studied in-depth only when they are manifested under actual living conditions. For this purpose, an organism must be in natural or artificial conditions where maximum mobilization and intensity of its potential adaptive capacities are required for survival and preservation. Thus, the property of adaptation of a living system is, in essence, a measure of individual health. These properties can be evaluated and predicted both by extrapolation methods and by demonstrating certain traits (markers), measured by ordinary physiological tests. However, it should be stated, that thus far we know of few criteria that are informative enough, and there are virtually no theories for long-term forecasting

of the health status of living systems under extreme conditions, although some important data have been obtained on the prognostic role of some factors: hypodynamia, bacterial-viral and antigenic environment, neuropsychological tension, mutagenic background, etc. The clinical aspects of the adaptation process have been studied considerably better, for example, pathological processes (A. P. Avtsyn, 1972; S. S. Vayl', 1973), but continued development thereof is being substantially delayed because of the shortage of information about the mechanisms of adaptation processes in healthy living systems under extreme conditions and reversible (prepathological) states thereof (V. V. Parin, 1973).

Even greater difficulties arise when studying processes of human adaptation in the light of biosocial problems (P. K. Fedoseyev, 1976). It must be noted that the recognition of future significance of social factors in evaluating human biology, physiology, adaptation and pathology (N. P. Dubinin, 1966) imposes special requirements of future research on the adaptation problem, not only in the sociohygienic aspect, but in the light of problems of evolution, biology and genetics of man, human populations and the Homo sapiens species (N. P. Dubinin, 1977). As for the latter, we should like to warn against inadequately substantiated efforts to use data concerning systemic organization, thermodynamics and evolution of some ecosystems in nature to interpret the state and evolution of anthropobiocenoses, efforts to broaden the range of the isomorphism of biological, biosocial and social systems without consideration of their qualitative differences. At the same time, we should call special attention to the study of problems of biospherogenesis, the patterns of which are far from being disclosed through current knowledge in evolutionary biology (A. A. Lyubishchev, 1968). This is all the more important since the ever increasing process of technogenesis and noospherogenesis has already, in essence, involved the surface of the entire planet and the circumplanetary cosmic space. Mankind, as it alters its environment, bears the entire responsibility for the future, which is inconceivable apart from the laws of biology, psychophysiology and other bases of vital functions.

The main factual material presented in this monograph is referable to the results, summarized by this author, of complex scientific research conducted for the last 5 years by scientists at the Institute of Clinical and Experimental Medicine, Siberian Branch of the USSR Academy of Medical Sciences: L. Ye. Panin, V. Yu. Kulikov, V. V. Lyakhovich, M. A. Yakimenko, L. A. Kovalenko, M. M. Yegunova, Ts. P. Korolenko, V. I. Turchinskiy and other members of the institute staff, to whom this author expresses his appreciation, as well as I. A. Privalov, L. G. Matros and D. N. Mayanskiy for their great assistance in preparing this monograph.

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INDUSTRIAL PSYCHOLOGY, PSYCHOHYGIENE AND PSYCHOPROPHYLAXIS REFERABLE TO SEAFARING PERSONNEL

Moscow PSIKHOLOGIYA, PSIKHOGIGIYENA I PSIKHOPROFILAKTIKA TRUDA PLAVSOSTAVA in Russian 1979 pp 1-8, 73-74, 135

[Annotation, review, author's preface, introduction and table of contents from book "Industrial Psychology, Psychohygiene and Psychoprophylaxis Referable to Seafaring Personnel", by A. A. Repin, Izdatel'stvo "Pishchevaya promyshlennost'", 135 pages]

[Text] At the present time, problems of naval psychology are becoming increasingly important. And this is understandable. The vast expanses of the world's oceans are constantly plowed by hundreds and thousands of commercial vessels, aboard which there are tens of thousands of Soviet seamen-fishermen at work. This book deals with the most important problems of industrial psychology and psychoprophylaxis as they relate to the labor of seafaring fishermen. It systematizes psychologically significant extreme factors that may be present in the professional activities of vessels in the fishing fleet; practical recommendations are offered for attenuation of the adverse consequences of emotional stress; results of many years of research by the Industrial Medicopsychological Laboratory of the USSR Ministry of the Fishing Industry are submitted; methods of autogenic conditioning [biofeedback?] developed specially for ship crews are described.

Review

This book deals with psychology, psychohygiene and psychoprophylaxis for the fishing fleet. There is a survey of data in the literature, the author's own findings, referable to studies of mental health of seamen conducted since 1961 both on land and on ships during periods of long-term cruises. Analysis is made of extreme factors in the work of seafaring personnel. There is systematization of the causes of psychological disharmony occurring in seamen during ocean voyages. The activities of the Industrial [sectorial?] Medicopsychological Laboratory of the USSR Ministry of the Fishing Industry, founded in 1974, are described; they are directed toward development of recommendations referable to psychology, psychoprophylaxis and psychotherapy as related to the fishing fleet. A system of on the job psychological training and modification of the method of autogenic training are described; there is a comparative evaluation of methods of psychotherapy and psychoprophylaxis used in the fleet, and specific recommendations are offered for adoption thereof, with the use of a specially prepared record and popular science movie. There are 26 tables, 2 illustrations; bibliography lists 206 items.

Author's Preface

Industrial psychology for representatives of seafaring occupations, organization of effective psychohygiene and psychoprophylaxis for the fishing fleet, problems of practical application of psychotherapeutic methods to regulate the emotional state of seafaring personnel during prolonged voyages have not yet been sufficiently studied. Without minimizing the importance of theoretical research in this field, it should be stressed that work on these problems has much applied significance. This book deals with the practical use of modern advances in psychology, psychoprophylaxis and psychotherapy in the fishing fleet. It gives some of the results of treating representatives of naval personnel in the psychotherapy office of the Sevastopol' Psychoneurological Dispensary, which served as impetus for organizing further observations, psychological studies and psychotherapy for ship crews in the course of prolonged voyages. An effort was made in this book to apply the theoretical advances of modern medicine, psychology and, in particular, some of the recommendations of the department of psychotherapy of the Central "Order of Lenin" Institute for Advanced Training of Physicians under the specific working conditions in the fishing fleet. Many of the issues discussed are organically linked with tasks advanced by the scientific and technological revolution; others deal with occupational psychological problems of naval personnel. Naval psychology is not yet formed as an independent branch of psychological science. This compelled us to turn to other, allied branches of psychology (industiral psychology, sports psychology, medical psychology, etc.), in order to make use of the experience gained by them to assess the psychological discords that occur in seamen during prolonged voyages. At the same time, it would be impossible to make an in-depth assessment of the psychological distinctions of the work of seamen without analysis of the psychological problems that seamen develop when they are ashore, as well as without investigation of occupational activities of on-shore fishery workers (for example, fish processers). For this reason, we have submitted some data obtained right at the OMPL [Industrial Medicopsychological Laboratory] and on-shore fish canneries.

While working on this book, substantial difficulties had to be overcome to make it equally useful to specialists in scientific organization of labor, safety practices, labor safety, commanding officers and ship physicians in the fishing fleet. The same circumstance compelled us to explain some medical and psychological terms that are well-known to physicians.

Recently, the USSR Ministry of the Fishing Industry adopted a decision to expand the work of the laboratory and organize a clinical base for it. The OMPL Exposition, which was named "Functional Model of a Hypnotharium," at the "Labor Safety--1978" exhibit of the Exhibition of Achievements in the National Economy of the USSR inspired considerable interest on the part of the visitors and a good rating in the press.

The popular science film, which is disucssed in this book, was awarded a silver medal in 1978 at the International Film Festival for labor safety in socialist countries.

At the present time, the scientific and practical endeavors of the OMPL, which are coordinated by the Problem Commission for "Physiology and Pathology of Man's Adaptation to Ocean Conditions," are developing in the direction of investigation of the possible use of modern advances in reflex therapy for the fishing fleet.

The author expresses his profound gratitude to professors L. I. Aleynikova and V. P. Khvatova, who offered a number of valuable comments and suggestions about the manuscript, to the staff of OMPL, as well as to ship physicians who were helpful in introducing the recommendations elaborated in the laboratory.

Introduction

The second half of the 20th century is characterized by intensive scientific and technological progress, which is associated with an increased neuropsychological burden on man. Under such conditions, preservation of mental equilibrium is a most important prerequisite for efficiency of any purposeful activity, any form of work, and requires special psychological flexibility, a special reserve of "spiritual strength."

The scientific and technological revolution is associated with intensive development of the environment and a search for new raw material, energy and food resources. Many new marine specialties have appeared. There have been radical changes in one of the most ancient professions, the occupation of a seaman-fisherman. Fishermen now have modern, swift vessels equipped with the latest, reliable radioelectronic equipment, automatic machines, which are capable of prolonged self-sufficient voyages. Good living conditions have been provided aboard these vessels, and there are interesting schedules for recreational activities for seafaring personnel. The safety of sea voyages has increased significantly. Introduction of mechanization of production processes has relieved ship crews of unsurmountable physical labor. But, along with these positive changes, there are negative factors that still persist, such as emotional stress and nervous fatigue.

There is a set of causes of neuropsychological burdens on fishermen engaged in long-term ocean fishing. It must be stressed that, unlike representatives of other maritime professions, fishermen work under particularly difficult [complicated] conditions, which will be described below.

The monotony of the surroundings, against the background of the inevitable shortage of exhaustive information about their families and loved ones, is sometimes the cause of depression and anxiety among seamen. The high psychoemotional burdens are also related to the need for intensive searching of fish, manipulation of an enormous trawl net [or line] in a sea area where there is a large concentration of vessels, mooring ships to one another in the open sea, etc.

The main factors that lead to neuropsychological stress in ocean fishermen can be classified as follows:

Prolonged absence from home and family, with inevitable shortage of information about loved ones, which generates a feeling of anxiety and melancholy.

Rigid psychological dependence on the results of the vessel's work in the case of an unstable fishing situation, and related work loads that are not uniform in intensity.

A sense of unfinished actions, constant anticipation generated by many months asea.

Considerable volume of monotonous work operations of fish processers working on a fish-cutting [trimming?] conveyer, in the presence of superfluous monotonous stimuli (noise from vessel's machinery, rolling, vibration), which impair flexibility and dynamics of nervous processes.

Constant heightened readiness in case of emergencies, which leads to formation of "watch points" in the central nervous system of commanding officers, which are "attuned" around the clock to the operation of different instruments and devices and overburden the nervous system.

Work under difficult meteorological and navigational conditions (storm, fog, ice, etc.), which disrupts circadian biorhythms and is associated with marked neuropsychological stress in ship navigators.

Strain on the dynamic stereotype (mechanisms of neuropsychological adaptability to the surroundings), due to a significant difference between the life style aboard a ship and on shore.

Increased anxiety and concern of seafaring personnel for their general and sexual health, due to the prolonged voyages.

This is far from a complete list of the causes that could lead to so-called neurotic reactions and, in severe cases, cause development of neurosis, cardiovascular diseases, peptic ulcers, etc. Hence, the obvious importance of studies for the introduction of means of psychohygiene, psychoprophylaxis and psychotherapy in areas where work involves extreme or stress factors leading to neuropsychological burdens. Such occupations also include that of seamen in the fishing fleet.

Aside from neurotic reactions and neurosis, seafaring personnel also develop vegetovascular disturbances and other diseases related to changes in functions of the autonomic nervous system. The author had the opportunity to investigate this problem, ranging from the arbitrary norm in the situation of ordinary work of ship crews to clinically distinct forms of neurosis of seamen who have undergone treatment in the psychotherapeutic office of the psychoneurological dispensary and Industrial Medicopsychological Laboratory. Complex psychological and physiological studies, clinical examination of specific cases of diseases of the nervous system among seamen revealed that neurotic reactions and vegetovascular disturbances were present in an average of 25% of the number surveyed. And, although this figure can vary widely in studies of crews of different vessels, the fundamental principles of Soviet medicine make it imperative to take prompt constructive steps for early detection, prompt prevention and treatment of functional diseases of the central nervous system.

Serious efforts are being made in this direction by the Department of Safety Practices and Labor Safety of the USSR Ministry of the Fishing Industry, and the Industrial Medicopsychological Laboratory established at its initiative, which is involved in the study of causes of nervous system diseases in seamen, introduction of effective means of psychohygiene, psychoprophylaxis and psychotherapy of neurotic disturbances in seafaring personnel and workers of on-shore enterprises of the fishing industry.

However, use of psychotherapeutic methods beyond the walls of therapeutic institutions, i.e., under nonclinical conditions and, in particular, on ships,

advances some specific problems and, until recently, practicing physicians seldom encountered a need to solve them. These problems are complex and diverse. They are closely linked with social psychology, since it is necessary to make a comprehensive study of group, collective activity, joint behavior, means of psychological communication, problems of psychological compatibility, personality distinctions, etc. A special role in solving them is played by psychiatrists, psychotherapists and medical psychologists, who are called upon not only to detect nervous and mental illness at the early stages, but to develop and introduce special psychoprophylactic and psychotherapeutic measures. In this respect, methods of psychological self-regulation, in particular, autogenic training, opens up wide possibilities; it has already found applications in aviation, cosmonautics, sports, pedagogics and other fields in different variants and modifications. Studies conducted aboard vessels of the fishing fleet revealed that methods of psychological self-regulation, including autogenic training, are an effective means of preventing nervous, cardiovascular and other diseases. Autogenic training helps control one's emotions, create flexible, labile and stable higher nervous activity, trains will, memory and attention. All this is very needed by people who work under complicated conditions and, in particular, seafaring fishermen.

The Industrial Medicopsychological Laboratory of the USSR Ministry of the Fishing Industry, together with the Department of Psychotherapy of the Central "Order of Lenin" Institute for Advanced Training of Physicians, developed a stereophonic record, entitled "System of Industrial Psychological Training," for introduction on a broad scale of autogenic training aboard vessels in the fishing fleet. The system of industrial psychological training (SPPT) and a modification of autogenic training have undergone a trial in the psychotherapy office of a municipal neuropsychiatric dispensary, during ocean fishing voyages in central and eastern parts of the Atlantic Ocean, at an on-shore fish cannery and at the Industrial Medicopsychological Laboratory. The record that was made on the basis of the results, with recording of two variants of autogenic training, and a popular science film on autogenic training, as well as specially developed radio equipment for transmission of psychotherapeutic information make it somewhat easier to do psychotherapeutic work with large groups of seamen. However, direct psychotherapy, i.e., the psychotherapist who establishes contact with ship crews, plays the leading role. In the course of such work, seamen becan to comprehend the significance of methods of psychological self-regulation to their health. Studies revealed that such a psychotherapeutic approach is effective, both in the course of fishing in the ocean for treatment of seamen presenting neurotic reactions and neurosis, and for treatment of representatives of ship crews with clinically distinct forms of neurosis at the Industrial Medicopsychological Laboratory.

6. Extreme Factors in the Work of Seafaring Personnel

[Excerpt] The general extreme factors inherent in all seafaring personnel include the following: shortage of meaningful information; monotony and sensory isolation; continuous, around the clock mode of work; hypodynamia and hypokinesia (limited motor activity); constant psychological readiness for emergencies or accidents; authoritarian style ofcontrol and management; considerable psychological dependence on success of fishing; sexual abstinence; combination of work atmosphere and habitat; effect of characterological, personality traits of individual members of ship crews on those around them ("psychological press"

factor); uncertainty and anticipation; burden on the dynamic stereotype related to the considerable difference between life style aboard the ship and on shore.

Additional extreme factors inherent in specific occupational groups include the following:

For navigators--control of ship with trawling gear under difficult meteorological conditions (fog, rolling, etc.); intensive search for fishing zones; mooring ships to one another in the ocean; higher administrative and moral responsibility for viability of the vessel.

For mechanics--work in a confined area without port holes; increased noise, vibration, and the heat factor; responsibility for continuous, around the clock operation of the vessel's machinery.

For ship's radio operators--search for useful signal within rigidly regulated period of time in the airwaves that are loaded with interference; effects of intensive electromagnetic fields.

For fish processers--excessive amount of monotonous work operations on a conveyer, with low interchangeability; working in areas without port holes; around the clock work schedule in shifts; uneven work load related to the instability of the fishing situation.

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PSYCHOLOGY

PSYCHOLOGICAL MECHANISMS OF REGULATING ACTIVITY

Moscow PSIKHOLOGICHESKIYE MEKHANIZMY REGULYATSII DEYATEL'NOSTI in Russian 1980 (signed to press 15 Jul 80) pp 2-5, 256

[Annotation, introduction and table of contents from book "Psychological Mechanisms of Regulating Activity", by Oleg Aleksandrovich Konopkin, Institute of Psychology, USSR Academy of Sciences, Izdatel'stvo "Nauka", 5000 copies, 256 pages]

[Text] This book submits the results of studies of the determining role of the process of conscious regulation of activity. A systematic structural and functional analysis is made of the integral process of conscious regulation. It is shown that the proposed conception of the process of conscious [aware] regulation can be used as a means of analysis and optimization of various forms of voluntary (including occupational) activity of man.

This book is intended for psychologists, psychophysiologists, as well as workers in different specialties that solve practical problems of designing and optimizing work activities.

Introduction

The problem of patterns and mechanisms of man's voluntary regulation of his activities is one of the global ones in psychology. Development thereof is determined by many lines of theoretical development of different branches of psychology and effectiveness of applying psychological knowledge to various practical areas.

Studies of active, constantly acting man by a psychologist (whatever the branch of psychology he deals with) inevitably lead to his encountering questions of patterns of performance, by a child or adult, of some type of activity, mental, "internal" or "external," game or study, work or sports, etc. And often, the task for the psychologist is to find the means of optimizing man's activity, his behavior as a whole, to find the causes of certain failures or deviations, to teach man what and how to act so that his particular work, his particular purposeful activity would be successful. Optimization of any activity at the different stages of its formation--be it the first steps in learning or 'polishing' already acquired professional skill--requires knowledge about the basic psychological patterns in the structure of regulatory processes that implement efficient performance of voluntary activity.

Psychology and first of all practicing psychologists (in education, medicine, sports, industry) are well aware of the need for such knowledge; however, there

are still not enough data available to psychology. There are not enough either to construct a general conception of mental regulation of activity or to create more specialized theoretical models reflecting different levels of psychological regulation.

The problem of voluntary regulation is complex and multifaceted. This book deals with only a few of the important aspects of the problem. It is concerned with the conscious level of the process of voluntary regulation of sensorimotor activity and is governed, first of all, by the task of demonstrating the internal structure of this process, i.e., singling out its different components that have specific purposes and establishment of consistent relations between them within the framework of a single process of conscious regulation of activity.

The initial theoretical and methodological basis for the study summarized in this book is the thesis, substantiated by Marxist philosophy and Soviet psychology, according to which man is viewed and studied as an active subject of activity who reflects reality adequately and consciously in his practical endeavors. This book as a whole is the experimental development of this methodological thesis and its use in the psychological conception of regulation of activity.

This book offers theoretical validation and experimental proof of the fact that sensorimotor activity of man as a function of a set of objective conditions under which it is performed is mediated by the process of purposeful regulation. The latter is based on conscious reflection and evaluation of conditions for the purpose of successful performance of activity. It is expressly conscious regulation that is the supreme element in the system of factors that determine man's sensorimotor activity, including its most elementary forms.

The data in this book indicate that the process of conscious regulation directed toward a single goal has a consistent internal structure, in which each of the elements performs a specific regulatory function. It is only the systemic combination of these factors that provides for the ultimate effectiveness of purposeful regulation of activity.

This book also offers an overall description (conceptual model), which is based on concrete data, of the functional structure of the process of conscious regulation, with which maximum efficiency of sensorimotor activity is achieved with regard to the goal set by the subject. The model of the process of conscious regulation, which reflects its internal structure, is offered as a means of standardized analysis of this process in specific forms of activity. Such analysis is aimed at demonstration of the possible structural and meaningful defects in the process of self-regulation, and it could serve as the basis for purposefully affecting different elements and parameters of activity by means of appropriate organization of the process of its conscious regulation.

The results of studies submitted in this book disclose the psychological mechanisms of self-regulation mediating the dependence of various forms of sensorimotor activity on such important features of the environment as physical qualities of signals, time-related uncertainty of events (signals) that are significant in the context of the activity, different time characteristics of the flow of stimulus signals, probabilistic characteristics of separate events and structural distinctions of the sequence of signals. The main parameters of sensorimotor activity, which characterize its efficiency and reliability (speed, accuracy, standardness

of timing of action, maximum duration of efficient work) were demonstrated as they consistently relate to the specific distinctions of realization of the process of conscious self-regulation.

Sensorimotor activity is a typical and diverse form of man's purposeful activity. The conceptual model, which the author proposes for the process of regulation, is rather universal in his opinion.

The book consists of the following logically connected parts: formulation of tasks, introduction to the problem, validation of different aspects of research (Chapter 1); isolation and study of different components of the process of regulation, their interrelations and relations (chapters 2-5); description of general functional structure of the process of conscious regulation of activity, and demonstration of the various possibilities for using the model of this structure as the basis for achieving specified influences on the results of activity (Chapter 6).

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WAR. THE OCEAN. MAN. MORAL, POLITICAL AND PSYCHOLOGICAL TRAINING OF SEAMEN IN THE SOVIET NAVY

Moscow VOYNA. OKEAN. CHELOVEK. O MORAL'NO-POLITICHESKOY I PSIKHOLOGICHESKOY PODGOTOVKE SOVETSKIKH VOYENNYKH MORYAKOV in Russian 1980 (signed to press 31 Aug 79) pp 2-5, 246-247

[Annotation, introduction and table of contents from book "War. The Ocean. Man. Moral, Political and Psychological Training of Seamen in the Soviet Navy" edited by Admiral V. M. Grishanov, second edition, revised and enlarged, Voyenizdat, 20,000 copies, 247 pages]

[Text] This book was written by a team of authors consisting of the following: G. A. Bronevitskiy, Capt 1st rank, candidate of psychological sciences; I. Ya. Ivanov, Capt 1st rank, candidate of pedagogic sciences; N. N. Makeyev, Capt 1st rank, candidate of historical sciences; and A. M. Stolyarenko, Capt 1st rank, doctor of psychological sciences.

As in the first edition, the authors shed light on the distinctions of moral-political and psychological training of Soviet naval seamen, the principal forms and methods of work to increase the political and military education of sailors, petty officers, michmans, ensigns and naval officers.

This book is intended for naval commanders and political workers, party and komsomol aktiv, instructors, auditory and students at naval educational establishments.

Introduction

The Soviet Union is constantly implementing Lenin's policy for peace, speaking up for strengthening the safety of nations and broad international collaboration.

Article 28 of the new constitution of the USSR states: "The foreign policy of the USSR is directed toward providing favorable international conditions for the building of communism in the USSR, defense of national interests of the Soviet Union, support of the struggle of people for national liberation and social progress, prevention of wars of aggression; achievement of universal and complete disarmament and systematic implementation of the principle of peaceful coexistence of nations with different social regimes."

As it implements the policy of peace, the Soviet government is waging a persistent and systematic struggle for deeper detente of international tension, for

carrying out the Final Act of the All-Europe Conference, for the nonuse of force in international relations and for eradication of sites of military danger. "The most urgent and pressing task for mankind," stated L. I. Brezhnev at a meeting with voters in the Baumanskiy voting district of Moscow on 2 March 1979, "has become in our times to cease the arms race, prevent the danger of worldwide nuclear war. The Soviet Union, like other socialist countries, spares no effort to reach these goals."*

However, the reactionary forces of imperialistic nations oppose international detente, building up their military preparations, inflating military budgets, intensifying the race for strategic arms, and are developing new, more destructive types of mass annihilation weapons. Under the cloak of false statements that there is a Soviet military threat, the militaristic circles are engaged in material and psychological preparations for a new world war. They are reinforcing aggressive military blocks, expanding their military presence in all parts of the world and blowing up military psychosis.

The venturesome course taken by the present leadership of China also presents a great danger to the cause of peace. Chinese leaders have promoted to the rank of national policy the breakdown of international detente and provocation of military conflicts. This policy is close to the most reactionary forces staked for aggression and war.

The difficulties on the road of disarmament, provocations of reactionary forces and their intensification of military psychosis require the utmost increase in alertness, intensification of efforts in the struggle for peace and alliance of all its proponents. The Soviet Union is struggling decisively on the international area for elimination of the possibility of reactionary forces unleashing a new war. At the same time, there is manifestation of concern for strengthening our country's defense capability and upgrading the Soviet Armed Forces. The defense of freedom and independence of our socialist homeland, safety of the peoples of the USSR, protection along with fraternal armies of other countries in the socialist camp of the great conquests of socialist constitute the main element in the common efforts of peoples to assure a firm peace on our planet. "The Soviet Union is effectively concerned about its defense," observed comrade L. I. Brezhnev, "but it is not and will not strive for military supremacy over the other side. We do not want to disrupt the approximate balance of military strength that now exists, for example, between the east and west in Central Europe, or between the USSR and the United States."**

The Soviet Army and Navy have the most modern weapons and combat technology. But this is not all that provides their combat might. The Soviet soldier, with his profound ideological convictions, high political maturity, infinite loyalty to the Communist Party and his military obligation to the people, awareness of his personal responsibility for defense of his homeland--this is the decisive force that assures supremacy over any aggressor.

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*Brezhnev, L. I. "Vo imya schast'ya sovetskikh lyudey" [For the Sake of Happiness of the Soviet People], Moscow, 1979, p 19.

**Brezhnev, L. I. "Leninskim kursom. Rechi i stat'i" [On Lenin's Course. Speeches and articles], Moscow, Vol 6, 1968, p 596.

The Communist Party constantly devotes much attention to the upbringing of Soviet soldiers [warriors]. In the decree of the CC CPSU, "On Further Improvement of Ideological and Political Educational Work," it is noted that it is imperative to institute measures directed toward continued intensification of the educational role of the Soviet Armed Forces.

Soviet military science is based on Lenin's interpretation of the correlation between man and technology in wartime, constant increase in the role of the moral factor under modern conditions. The studies of scientists in this field are being realized in the practice of moral-political and psychological training of the Soviet military. For this reason, regular publication in the press of the recommendations in scientific studies, tested in the course of combat and political training of troops, is important to improvement of this work.

In the second edition of the book, "War. The Ocean. Man," as in the first, there is discussion of questions of moral, political and psychological training of personnel in the Navy. The book does not presume to shed exhaustive light on the problems raised. Each of them could be the topic of a special investigation. The purpose of the book was to help commanders and political workers, party and komsomol organizations in solving tasks of moral-political and psychological training of naval personnel.

The authors express their gratitude to all commanders and political workers who sent their comments, advice referable to the first edition of the book, thereby rendering practical help in the work on this edition.

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